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"Promotion of Knowledge of Materials of Engineering and Standardization of Specifications and Methods of Testing"

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The A.S.T.M. at War

While the thought of a technical society being at war may appear rather bizarre, nevertheless the A.S.T.M. is definitely on a war footing. Its procedure has been "streamlined" and emergency measures have been taken to expedite committee work and to carry on most effectively under present conditions. Practically every activity undertaken is carefully scrutinized in the light of its value as a contribution to the war effort. Obviously certain activities will need to be curtailed and any necessary restriction should, of course, be made in those activities that seem to have the least immediate service value.

In the January ASTM Bulletin mention was made of the study that was being given by the Executive Committee on the effect the war might have on the Society and in what way the Society could be of most assistance in the war effort. This was discussed with the officers of all standing committees and the attitude being taken by these committees is extremely interesting. Naturally enough, most of them concurred in the thought that the committee efforts should be directed primarily toward modification of A.S.T.M. standards to keep them in line with the needs of the war production program. However, there was stressed the necessity of new specifications that would be instrumental in promoting production. In addition to this, thought is being given to the development of quicker test procedures and alternate methods that would serve to expedite inspection and production control. In other words, one of the answers seems to be standardization and still more standardization.

However, apart from this the standing committees are cognizant of the value of continuing the research programs that are under way either in the study of test procedures in order that unification may be effected or in long-time tests of materials which programs might lose their value if current inspections are dropped.

In order to carry on these various endeavors, the members are exerting extraordinary efforts in an unselfish endeavor to do whatever falls to their lot. The promptness with which the individuals are ready to respond is truly inspiring. Meetings are called on short notice with a resulting attendance that would be considered most astonishing if one did not appreciate the seriousness of the work in hand. No personal engagements are permitted to interfere.

We do not propose at this time to give a complete recital of the numerous activities under way, although from time to time it is our plan to repeat the sort of information outlined in our August Bulletin. It might be well, however, to call attention to the promptness with which the B-2 subcommittee dealing with babbitt metal and solder went into action as soon as it became apparent that there would be a serious shortage of tin. Emergency modifications were immediately developed covering new grades so as to conserve the amount of tin used. These compositions were made ready for promulgation as soon as the official tin order would appear. Similarly, a B-5 subcommittee has been active in the modification of compositions for brass and bronze castings.

Mention might also be made of the preparation on the part of Committee B-1 of complete new specifications covering lead-alloy coated wire, referred to elsewhere in this issue, to replace the usual tin-covered wire. Similar work is now well advanced in Committee A-5 on specifications for lead-coated hardware for use in lieu of zinc-coated hardware. Many similar instances might be cited in connection with our steel specifications where Committee A-1 has and is offering a number of recommendations in the interest of expediting production and conserving such elements as copper and manganese.

While most instances of this sort are naturally in the field of our long-established committees, one instance particularly noteworthy was the decision of one of our newer committees, Committee C-16 on Thermal Insulating Materials, at its recent meeting in Cleveland to set aside its regular work in order to proceed immediately with the development of six or more urgently needed specifications in the thermal insulating field, utilizing such test procedures as might be available.

But apart from the writing of specifications and emergency modifications, our committees are naturally looked to for advice and suggestions in expediting production. Many members of the steel committee, for example, are serving on committees of the War Production Board in the establishment of national emergency steel specifications. As soon as there were indications that a shortage in cement might be imminent, our Committee on Cement was called upon for recommendations in connection with ways and means of conserving production capacity. Again acting on short notice, the committee had a well-attended meeting and formulated recommendations that were shortly in the hands of the War Production Board. Doubtless there will be numerous other occasions when the advice of our committees and of committee members will be sought.

It is of course but natural that individuals such as those serving on A.S.T.M. committees, whose technical knowledge is of such great importance in solving the many problems incident to the war effort, should be so much in demand. In addition to seeking their advice, many are being called into the Government services. The Society can, of course, lay no claim to their contributions, but either as individuals or as an organization the Society is doing its utmost in carrying on the war.

Forty-fifth Annual Meeting in Atlantic City, June 22 to 26, 1942

Many Technical Sessions Including Extensive Symposium on Radiography; Committee Reports Important Because of Book of Standards Year

With the War focusing attention on materials and stressing the necessity of all possible information on their properties, the Forty-fifth A.S.T.M. Annual Meeting to be held at Chalfonte-Haddon Hall, Atlantic City, will be of unusual significance. Scheduled for June 22 to 26, inclusive, the technical sessions and committee meetings will stress many problems of vital concern in the present emergency.

Because 1942 is Book of Standards year and this important volume will be issued complete in its three parts, publication being scheduled for November, the reports of the standing committees will be particularly significant. And they will be significant for another reason—because a large number of committees are setting up emergency alternate provisions and have acted to approve complete emergency alternate specifications to keep standards in line with the changing picture of supply and changes in the quality and kind of materials.

Two outstanding technical features will be the Symposium on Radiography, for the presentation of which probably three sessions will be required, and a Discussion on Solvent Action of Water Vapor at High Temperature and Pressure, which, although scheduled as a round-table discussion, will probably actually be more of an extensive formal session.

There will be no apparatus exhibit at the meeting this year, in line with the Society's plan of sponsoring such exhibits every two years—in the odd-numbered years—the last one having been held in Chicago in 1941. Also, no photographic exhibition and competition will be scheduled this year.

Technical Program

Symposium on Radiography:

One of the Society's most important technical publications was the Symposium on Radiography and X-ray Diffraction Methods held at the 1936 annual meeting, with twelve extensive technical papers by leading authorities, the published papers and discussion being the first comprehensive book to cover this field in the English language. While the book was widely distributed following publication, there has been a new emphasis on the applicability of the volume within the last year because of increased production and increased use of radiographic methods and testing by diffraction. As a matter of fact many copies of the book have been sold in connection with national defense training courses, several universities giving courses in these methods of nondestructive testing.

Continuing emphasis in this field and new developments in million volt X-ray equipment have led members who are leading authorities in this field and active in Committee E-7 on Radiographic Testing, headed by Dr. H. H. Lester, to develop another symposium. It is planned for three sessions. Some of the country's outstanding authorities, most of whom are directly concerned with applications of various gamma and X-ray procedures, will participate either through the presentation of formal technical papers or in leading discussion. To give some idea of what is planned a tentative list of topics to be covered follows: Low-voltage X-rays; X-rays in inspection of aluminum aircraft parts; examination of welds and weldments; examination of steel castings; million volt X-ray equipment; high voltage X-rays in the weld shop; million volt X-rays and steel castings; high voltage penetrative ability and radiographic sensitivity from one to three million volts; protection of workers; gamma ray radiography of welded high-pressure piping; and positioning of penetrameters.

Plans and details are being handled by a special program committee headed by Lars Thomassen, Associate Professor, Department of Chemical and Metallurgical Engineering, University of Michigan; with H. E. Seemann, Physicist, Eastman Kodak Research Laboratories, Eastman Kodak Co., and J. T. Norton, Associate Professor of Metallurgy, Massachusetts Institute of Technology, also serving.

Round-Table Discussion on Solvent Action of Water Vapor at High Temperature and Pressure:

With higher operating temperatures and pressures which seem to have followed an upward curve similar,

if not exactly parallel, to our national debt, A.S.T.M. Committee D-19 on Water for Industrial Uses has selected as its special contribution at the annual meeting to sponsor this round-table discussion in which many of the prominent leaders in the field will participate. In line with the Society's practice for previous round tables, this will not be a so-called "talk fest," but the men will come with prepared discussion which probably will be given precedence and those in charge of arrangements headed by Max Hecht, Adviser, Power Stations Chemistry and chairman of Committee D-19, and R. E. Hall, Director, Hall Laboratories, Inc., and secretary of D-19, will see that major problems are covered, to be followed by open discussion from the floor.

All of the technical sessions and symposiums sponsored by Committee D-19 have been very worth while and this latest one to be held in Atlantic City in June should be no exception. The committee's 1941 Symposium on Problems and Practices in Determining Steam Purity by Conductivity Methods is considered an outstanding piece of work and has evoked widespread interest.

Sessions Replete with Technical Papers

As might be expected in a Book of Standards year, practically all of our standing committees will be presenting reports submitting recommendations on standards under their jurisdiction, in order that the standards as printed in the Book of Standards will be up to the minute. As something more of a surprise, however, in view of present conditions in industry, which might be expected to discourage the preparation of technical papers, our Committee on Papers and Publications has had submitted to it an exceedingly large number of offers. Accordingly, it will be possible to develop a well-rounded program of papers, many of them covering subjects that will be of direct interest in connection with the war effort. Many investigators have information to contribute that they believe would be helpful to the industry at large, and accordingly they consider it important that extra efforts be made to have the data developed and presented as technical papers before the Society.

Hotel Reservations

Early in May there will be sent to each member a blank giving hotel rates at Chalfonte-Haddon Hall with a form which members can use in making reservations for the meeting. Members who wish can at any time send reservations to the hotel, explaining that they will be attending the A.S.T.M. meeting. These should be addressed to the hotel management, Chalfonte-Haddon Hall.

Atlantic City Children's Week June 26 to July 2

The Atlantic City authorities have selected the week of Friday, June 26 to Friday, July 3, inclusive, as annual Children's Week, at which time all children under 12 years of age, accompanied by an adult member of their family and registered at Chalfonte-Haddon Hall or another cooperating hotel, are invited to be guests of the resort. By this plan, members who wish to bring the younger members of their families, can, if they choose, spend an extra few days at the shore, and the children can paint the town red with no expense to their parents.

Provisional Program

The Provisional Program for the meeting with the various items arranged according to sessions will be published in the May Bulletin, including synopses of each of the items. This advance program is of particular significance, since it provides members and those concerned with the important subjects to be covered with a well-rounded picture of what the meeting will cover.

In so far as possible, papers and reports will be preprinted. Each member will receive a preprint blank well in advance of the meeting so that he can request advance copies of papers and reports.

A-2 Extended for Use of Approved Laboratories

Preference Rating Order P-43, which assigns a rating of A-2 for the use of specifically approved scientific research laboratories, has been extended to August 31, 1942. It was scheduled to expire on February 28. Only research laboratories recommended by a committee of the National Academy of Sciences are permitted to use the rating assigned by this order.

1942 Standards to Aggregate Some 5000 Pages

Preliminary estimates for the Book of A.S.T.M. Standards which will be reissued in complete form in November of this year indicate that the book will involve some 5000 pages. Barring unforeseen circumstances, the same plan as for the 1939 edition will be followed, namely, publication in three parts. Part I on Metals and Part III on Nonmetallic Materials—General (petroleum, coal, textiles, etc.) will average about 1750 pages each. Part II on Nonmetallic Materials—Constructional (concrete, cement, timber, etc.) will contain some 1500 pages.

These figures are only approximate since they will vary depending upon the number of new specifications and tests approved by the Society as the result of committee recommendations at the annual meeting in June. Based on considerable experience it is not too hazardous to guess that these figures will be minimum.

Important Actions During Committee Week; Large Number of Standards Actions and Many Emergency Alternate Provisions

Two situations influenced markedly the 1942 A.S.T.M. Committee Week held March 2 to 6, inclusive, at the Hotel Cleveland, Cleveland, Ohio, namely, the present war emergency involving rapid changes in supply of materials both as to quantity and quality, and secondly, the fact that 1942 is Book of Standards year when a complete new Book will be issued.

A large number of committees held meetings, most of which were well attended, this being particularly true in such fields as steel, petroleum, rubber products, and paint. A list of the committees which met appears on this page. In most cases there were numerous subcommittee meetings, although in one or two cases as indicated only subcommittees met. The total registered attendance during the week was 520, considerably below last year's figure, which undoubtedly was influenced by the location in Washington, D. C., and other factors. However, the figure compares favorably with other such meetings.

Many new specifications were announced at the meetings but of particular interest were the many emergency alternate provisions which will be speedily enacted providing a means for keeping the specification requirements in line with the current situation. At the same time several committees adopted the rather unusual precedent of asking regular action through Committee E-10 on Standards instead of waiting for the annual meeting in June. Normally there would not be the urgency of issuing new specifications and tests, or revising existing ones prior to the annual meeting, but it was apparent and has been for some time that in some cases speed is very desirable.

The outlines given below of various committee activities will give some idea of the progress made and of the programs which the committees have under way. *Most of the actions taken at the meetings will, of course, be submitted to letter ballot prior to formal recommendation to the Society.*

In the case of emergency alternate provisions, the procedure requires approval by a subcommittee (or duly appointed subgroup) followed by approval of the main committee chairman and by Committee E-10 on Standards. Some of the committees including A-1 on Steel have issued a directive that all emergency alternate provisions must be approved by letter ballot of the subcommittee.

A-1 on Steel
A-7 on Malleable-Iron Castings
A-9 on Ferro-Alloys
A-10 on Iron-Chromium-Nickel
B-1 on Copper and Copper-Alloy Wires
B-2 Subcommittee III on White Metal Alloys
B-6 Subcommittee I on Aluminum-Base Die-Casting Alloys
C-8 on Refractories
C-9 on Concrete and Concrete Aggregates
C-11 on Gypsum
C-12 on Mortars for Unit Masonry
C-15 on Manufactured Masonry Units
C-16 on Thermal Insulating Materials
D-1 on Paint, Varnish, Lacquer
D-2 on Petroleum Products and Lubricants
D-4 on Road and Paving Materials
D-8 on Bituminous Waterproofing and Roofing Materials
D-11 on Rubber Products
E-1 Sections on Thermometers, Indentation Hardness, and Tension Testing
E-3 Subcommittee B-3 on Aluminum and Magnesium and Their Alloys
E-4 on Metallography
E-9 on Research
Sectional Committee A37 on Road and Paving Materials

Steel

The effect of the war emergency was very much in evidence at the several meetings of Committee A-1 on Steel. A number of new specifications were approved or referred to ballot and many emergency alternate provisions are to be established to promote conservation of manganese and copper, to expedite production or for other specific reasons. The work of the National Emergency Steel Specifications' committees functioning under A.S.T.M.-S.A.E.-A.I.S.I. sponsorship occasioned some actions on standards. The discussion below follows the subcommittee setup of Committee A-1.

Steel Rails and Accessories.—Actions in this field were primarily to bring A.S.T.M. specifications in line with similar changes which the American Railway Engineering Association will make in its specifications, both societies having coöperated closely in the War Production Board N.E.S.S. work. Standards of both groups are being proposed as master or control specifications. Following letter ballot approval in Subcommittee I and by Committee E-10, full details of the emergency changes will be announced.

In the Spec. for Open-Hearth Carbon-Steel Rails (A 1 – 39) some details of the drop test are changed, the Brinell hardness test made for information only is to be eliminated, and a requirement for control cooling is being added with recommended practice details given in an appendix. These changes are in the interest of increased production and simplification. In the Spec. for Steel Tie Plates (A 67 – 33) and for Hot-Worked High-Carbon Steel Tie Plates (A 241 – 41), all reference to copper (added on order in amounts of 0.20 minimum as a corrosion-resistance measure) is to be taken out for the duration to conserve this important non-ferrous metal. The subcommittee also acted to recommend in the Spec. for Heat-Treated Carbon- and Alloy-Steel Track Bolts and Nuts (A 183 – 40 T) that alloy-steel track bolts shall not be supplied during the emergency.

Copper Conservation.—In addition to omitting copper requirements in railroad tie plates the Steel Committee took one over-all emergency action affecting all of its specifications in which copper could be specified by the purchaser in the amount of 0.20 per cent minimum. The action specifies that all reference to such copper additions be eliminated in all of the A-1 specifications. This affects structural shapes, plates, and sheets. There was considerable discussion of this matter, it being pointed out that technically 0.15 minimum copper was, according to long-time A.S.T.M. tests, about as efficacious as the 0.20 per cent minimum and by using the lower figure much copper could be conserved, but to cooperate to the limit, the Steel Committee decided on the action taken.

Structural Steel for Bridges, Buildings.—While there was no meeting of this subcommittee a letter vote, taken first in the section which developed the specifications and then in the subcommittee, recommended for adoption as standard the Spec. fo. Low-Alloy Structural Steel (A 242 – 41 T). This is one of the most important specifications issued by Committee A-1 on Steel in recent years; it will become a formal standard in 1942.

Spring Steel and Steel Springs.—Of chief importance were recommendations to effect conservation in manganese. The problem fell into three parts: carbon steels and alloy steels for hot-formed railroad springs and spring wire for cold-formed springs.

In the three specifications for carbon-steel bars for springs, A 14, A 58, and A 68, with a manganese range of 0.25 to 0.50, it was considered impractical to drop the minimum since mills report that actual manganese is running in the neighborhood of 0.30 to 0.35 per cent, with current trends toward the lower figure. Also, with lower limits of manganese being used in the Spec. for Chromium-Vanadium Steel Bars for Springs (A 60 – 39) and for Silicon-Manganese Steel Bars for Springs (A 59 – 39), the present range of 0.60 to 0.90 will remain unchanged for the time being.

The subcommittee has six specifications covering various types of spring wire; four on carbon steel (A 227, A 228, A 229, and A 230) and two covering chromium-vanadium (A 231 and A 232). After discussion, the manganese range in A 228 (music wire) of 0.20 to 0.60 was left untouched, but the subcommittee felt it quite in order to delete as an emergency matter requirements on manganese in the other three carbon specifications so that the manufacturer, who must meet physical requirements, can save all possible manganese. The two alloy standards, A 231 and A 232, are to be studied further.

End-Quench Test for Hardenability of Steel.—At the request of producers and consumers of steel products who are concerned with the end-quench test for hardenability of steel, a Special Subcommittee on Hardenability recommended a proposed tentative method. This test, termed the "Jominy" test, consists of water-quenching one end of a cylindrical test specimen 1 in. in diameter and measuring how far from the quenched end the steel hardens. Details of procedure, test specimens, and water quenching device are provided, with examples and a suggested report form. An appendix covers specimens for special applications. A bibliography is also appended.

An important decision reached by the subcommittee provides for the arithmetic type of chart instead of the logarithm type, this action being based on the widespread use of the arithmetic chart and the fact that so much data now in existence have been plotted in this way.

Steel Reinforcement Bars.—Five of the specifications covering concrete reinforcing material were reaffirmed as being in line with current practice. These cover billet-steel (A 15), rail-steel (A 16), wire (A 82), bar or rod mats (A 184), and wire fabric (A 185). Emergency requirements will be set up in the Spec. for Axle-Steel Bars (A 160) to provide for the use of raw materials other than axles. An emergency soft structural grade is proposed, with a tensile range of 48,000 to 70,000 psi., and a minimum yield point of 28,000 psi.

Pipe and Tubing.—There was considerable discussion and activity in this field. Possibly of predominent interest were revisions for adoption this year establishing elongation requirements on the basis of thickness of pipe wall, following somewhat a similar setup in effect for specifications for structural steel and plates. It was stated that this method is more rational than the empirical methods now being used. Also, a new concept of specifying values for the widely used flattening tests was approved and tentative revisions will be published in the committee's report with possible action of adoption at the June meeting. This sets up a formula instead of specific values and is based on the size of pipe and relation to wall thickness. The extensive supporting data for these two major proposals will be published.

Recognition of an important product development was accorded in actions paving the way for use of acid Bessemer steel in Spec. for Welded and Seamless Steel Pipe (A 53 – 40) and Spec. for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Ordinary Uses (A 120 – 40) and eventually in the higher quality Spec. for Lap-Welded and Seamless Steel Pipe for High-Temperature Service (A 106 – 41). One of the largest producers has manufactured thousands of tons of Bessemer seamless pipe. In the field of high temperature applications considerable data on creep and related values were cited to justify the action.

Work to develop a standard for welded alloyed open-hearth iron pipe was approved.

The subcommittee in charge expects to approve tentative specifications for copper-brazed steel tubing, now made in small sizes in considerable quantity.

Another action of outstanding importance was the approval for prompt publication of tentative specifications for steel pipe piles. The producers have agreed on what seem to be logical properties and tests and on size recommendations. Minor revisions were made in the proposals at Cleveland and after an early letter ballot vote, it is expected the Society will issue the specifications, probably in April–May.

Sheet Steel and Steel Sheets.—To make its two important specifications, A 245 – 41 T covering light gage structural quality flat hot-rolled carbon steel (0.2499 and 0.1874 in. to 0.0478 in. in thickness), and A 246 – 41 T covering light gage structural quality flat rolled carbon steel (0.0477 to 0.0225 in. in thickness) complete in themselves, references to another standard covering tension tests are being deleted and the necessary requirements are being placed directly in the two standards. Further consideration is being given to the 8-in. gage length specimen and

whether it is entirely satisfactory in the standard covering the heavier gage material.

Welding Electrodes and Welding Rods.—Detailed studies and discussion of requirements for arc welding electrodes and gas welding rods in a joint subcommittee of the American Welding Society and Committee A-1's Subcommittee XXI headed by J. H. Deppeler resulted in the decision to approve with minor changes a new specification for gas welding rods and important revisions will be made in the Spec. for Iron and Steel Arc-Welding Electrodes (A 233 - 40 T). A request to the Society will be made to expedite action, possibly through a special coordinating committee, on specifications for aluminum alloy arc welding electrodes which are normally not in the province of the Steel Committee, but which in the American Welding Society are handled in the same main committee. The A.S.T.M. is being asked by Committee A-1 to issue these specifications at the earliest possible moment so that they will be referred to Committee E-10 on Standards with publication hoped for some time in April.

Other Actions.—The Spec. for Factory-Made Wrought Carbon-Steel and Carbon-Molybdenum-Steel Welding Fittings (A 234 - 40 T) which have existed two years as tentative are to be recommended for adoption as standard.

At a meeting to discuss establishing standard requirements for materials for use at subatmospheric temperature, many interesting points were brought out. While work had been contemplated only in the field of piping materials—flanges, pipe, forged fittings, etc.—it was evident that other products and other industrial fields are keenly interested. J. H. Romann, Chairman of the new section, will before the June meeting elicit information and data on specifications now used in the various fields which are particularly interested and develop other points so that in June the officers of Committee A-1 can decide the best means of approaching the problem.

Malleable-Iron Castings

Committee A-7 on Malleable-Iron Castings decided to send to letter ballot of the entire committee proposed specifications covering malleable-iron castings for flanges, pipe fittings, and valve parts. This is the first in a series of specifications that are expected to cover specific applications of the material. Although the requirements have not yet been approved by the standing committee, the draft indicates that castings are to be free from primary graphite and are to be given an annealing heat treatment to produce a blackheart structure. In the section on physical properties it is indicated that although malleable irons of higher physical properties are made, the properties set up are the basis for design and pressure ratings. Tensile strength is to be 40,000 psi. min.; yield point, 30,000 psi. min.; and elongation in 2 in. of 5 per cent minimum. Details of test specimens, workmanship and finish, and marking are given.

Decision to submit to the American Standards Association for approval two of the committee's specifications covering malleable iron castings (A 47 - 33) and cupola malleable iron (A 197 - 39) is a recognition of the widespread use and authoritativeness of these two standards which have been effective in A.S.T.M. for a number of years. In fact the requirements in A 47 have remained unchanged since 1933, but in line with recognized Society procedure the committee reaffirmed the up-to-dateness of the specifications and will include, when they are next printed in the 1942 Book of Standards, a note that they are in line with current practice.

There is continued interest in pearlitic malleable irons and suggestions on classifying these materials are to be referred to producers for comment.

Ferro Alloys

While there was much discussion concerning the status of specifications for various kinds of ferro alloys, the only specific action taken by Committee A-9 on Ferro-Alloys was to recommend the adoption as standard of Specifications for Ferrochromium (A 101 - 39 T), which have remained unchanged since 1939. The several other specifications in the charge of the committee are standard; they cover ferromanganese, ferromolybdenum, ferrosilicon, ferrovanadium, etc. The rapidly changing supply situation and the necessity of conserving our alloys and other elements, make it necessary for the standing committees of A.S.T.M. to consider the desirability of emergency alternate provisions or permanent changes in specifications. In some fields there is agreement that the standards should remain as they are, namely, in line with normal industrial practices and that the War Production Board or Army, Navy or related services' requirements will cover the unusual war emergency needs. In other fields standing committees have taken the attitude that it would be of definite assistance if emergency alternate provisions were established.

Iron-Chromium-Nickel and Related Alloys

Perhaps of particular interest at the meeting of Committee A-10 on Iron-Chromium, Iron-Chromium-Nickel, and Related Alloys was the announcement that the committee was releasing for publication the extensive tables of data covering corrosion-resisting and heat-resisting properties of iron-chromium-nickel and related alloys. These data have been in process of collection for many months and the information is expected to be extremely valuable as was the previous publication providing this information issued in 1930.

The group working on mechanical tests is instituting a series of investigations to determine that proposed methods covering hard rolled flat austenitic materials will be the most satisfactory method for elastic properties and to be certain that the method finally selected is reproducible in any properly equipped laboratory. Long-time studies in the field of metallography covering chiefly intergranular corrosion are practically completed and a final report is hoped for at the June meeting. Previous reports on this matter have been published, notably in the 1939 *Proceedings*.

The committee concerned with wrought products is planning to go ahead with its work, and in the field of sheets and flat products changes are to be incorporated in two existing specifications—A 167 covering corrosion-resisting chromium-nickel steel, and A 176, chromium steel sheet, strip, and plate—to bring the chemistries in line with current practice and the recently issued A.I.S.I.

For notes on other ferrous metals committees, non-ferrous metals, "C" and "D" groups, please, turn to page 49.

Navy Ordnance Inspection[1, 2]

By C. A. Misson[3]

THE PURPOSE OF Naval Ordnance Inspection, and its only reason for existence, is the insurance that the inspection offers to the procurement of the ordnance material which the fleet wants and needs.

Such material is purchased under specifications framed by the Navy Department Material Bureaus; specifications that describe material and all of the elements controlling its quality, treatment, dimensional and other tolerances, testing and inspection; specifications that incorporate the findings of naval and commercial research and testing laboratories which test mechanical and scientific developments adaptable to Navy use or peculiar to Navy use and the results of material testing in the vast laboratory of the fleet itself; specifications which describe material and methods which have been established as meeting the demands of the service. These demands are usually more severe than are encountered in commercial practice for similar materials, since the material has to withstand the movements and working of ships in heavy seas, the high instantaneous stresses of gunfire, torpedoes, mines, and bombs; the variable torsional stresses from rolling, pitching, and yawing; difficulties in lubrication caused by the movements, the unparalleled corrosive action of salt sea water, and the extreme temperatures of operating in arctic to torrid zones. You can, by considering these elements, begin to grasp the problems of the designer of delicate optical and fire control instruments which have to function perfectly throughout such influences; or the designer of an electrical-mechanical device which will establish and maintain within a tolerance of a small fraction of a degree of arc in space, the *R* and deflection of a moving spot on the sea perhaps 25,000 to 30,000 or more yards away; or the turret designer who must control with extreme delicacy a mass of upward of a thousand tons which shoots at that point; or the armor designer who designs a suit of armor for a ship which will withstand the blinding impact of a ton of metal concentrated on a point at an impact velocity of the order of a third of a mile a second, and concurrently develops projectiles which will defeat the armor; or the gun designer again, dealing with temperatures and pressures of such appalling magnitude that a failure of material must result in disaster, not only to the ship, but to the country—you can begin to understand why the specifications are necessarily concise and exacting, often to the point where they are regarded as arbitrary and impracticable.

No matter how expertly and carefully prepared, specifications lose their value and effectiveness unless the material conforms to them. The assurance of conformation of the material to the specifications of the designer, then, becomes the responsibility and trust of the inspector.

Inspection at the place and time of manufacture is fundamental in the interests of maintaining an unbroken record of each item entering into a unit assembled anywhere; in the detection of the inevitable errors in manufacture, and in establishing liaison between the contracting parties; in short for minimizing wasted time and effort.

This field inspection is administered by the Material Bureaus of the Navy Department in Washington through Inspection Districts into which the country is divided; each district headed by a Naval Officer who is designated as the Inspector of Naval Material. Headquarters for each district are usually located in the larger cities, such as Philadelphia and Pittsburgh, and from these headquarters inspection matters under the Inspector of Material's cognizance are administered directly from his office, or through branch offices scattered throughout the district at the various manufacturing plants. Naval Ordnance inspection is, in most districts, conducted by such offices. However, the Bureau of Ordnance maintains a number of separate inspection offices within these districts, where volume of specialized ordnance manufacture warrants. My office at The Midvale Co., in Philadelphia, is one of these.

The inspection personnel of an office such as mine are civil service men, most of whom were originally employed at the Naval Gun Factory in Washington—the heart of Naval Ordnance manufacture—in various capacities such as draftsmen, metallurgical laboraticians, and machinists; selected there for the position of inspector, and later transferred to this office for work in the same fields that they served in at the Gun Factory. The remainder are local men who have spent most of their lives in the service, or who have come into it recently by process of selection.

The Inspector's stock in trade consists of an alert interest in the product he is inspecting, a complete knowledge of its manufacture, an unbroken line of identification, establishment of its metallurgical and dimensional correctness by the use of accurately calibrated instruments, and the full knowledge of the obligations and moral responsibility with regard to the possibility of irreparable damage resulting from uncertainty in the discharge of his task.

The problems which arise in the field of administration in an inspection office in these piping days of priorities, security measures, plant expansions, and similar extra-curricular activities, are many and varied. Those which arise in ordnance inspection, as such, are few. The bulk of material inspected is satisfactory metallurgically and dimensionally and routine inspection is all that is required to send it on its way. Most inspection problems are made up of salvage possibilities in material manufactured through incomplete knowledge of, or misinterpretation of drawings and specifications; deficiencies in the chemical range; machining defects; or physical test deficiencies.

Chemical deficiencies are the most frequently referred to item, and since minor plusses or minuses do not usually affect the metal, or are correctable by slight changes in heat treatment, the general attitude in Ordnance toward such is a liberal one. Physical deficiencies are a horse of another color. Herein is the proof of the pudding, and

[1] The opinions and assertions contained herein are the private ones of the writer and are not to be construed as official or reflecting the views of the Navy Department or the Naval service at large.

[2] Presented at Metals Congress, Am. Soc. Metals, October 20–24, 1941, Philadelphia, Pa.

[3] Lieutenant Commander, U. S. Navy; Inspector of Ordnance, The Midvale Co., Philadelphia, Pa.

the requirements are, as a rule, adhered to. Naval Ordnance plants finish-machine the bulk of Ordnance forgings and castings, so that deficiencies in machining—the second most prolific source of trouble—become a matter of determining whether the piece will finish. Surface defects, excessive removal of metal, cracks, pipes, splits, flakes, streaks, laps, etc., are items which are measurable and whose effects are determinable by following the universal sequence of measuring and figuring.

The equipment for the measuring are the combined instruments of the manufacturing plant and the inspection force or, if necessary, of such plants as the Naval Gun Factory. The computing of affects is a matter of design or ballistics and is done by the Inspector, or the Bureau of Ordnance, or one of its agencies.

The liaison duties of the Inspector constitute, in my opinion, what is probably his most important duty, and certainly the most interesting. As the go-between of the contracting parties he represents the Bureau of Ordnance to the manufacturer, and, as he is the person on hand with some familiarity with the complexities of naval administration, he can be of considerable assistance to the contractor. It is astonishing to see what an amount of information is exchanged during the progress of a contract—in maintaining a meeting of the minds of the contractors.

As a final note on Inspection matters, may I pass lightly over the differences of opinion which arise in the production and Inspection activities, unavoidable differences born of zeal for doing a good manufacturing job, on the one hand, and zeal for doing a good job of inspection on the other. In the final analysis, everyone wants to do his best for Uncle Sam—especially for his present urgent needs—and interruptions are difficult to absorb when such appear on the surface to be inconsequential. Actually, there is usually merit to both sides of the question, and invariably—well, almost invariably—an equable solution is reached by a frank exchange of information. Having been on the production end in a previous tour of shore duty at the Naval Gun Factory—and inspection *versus* production at that plant is a very tangible affair—and on the inspection end during this tour, it appears to me that a mutual respect for the problems and responsibilities of each other is the thing most urgently needed.

In conclusion I should like to quote from a recent speech made by Admiral Blandy, Chief of the Bureau of Ordnance, at a presentation of a Bureau of Ordnance "E"; words which get at the root of the matters of production and inspection. He said:

"Even as I am speaking here, units of our fleet are ready for action. . . . They are carrying out their orders: Rid America's defense waters of every Axis raider. Every man is at his station. Every man is prepared to fight and, if need be, to die to defend his country's interests.

"But our seamen do not stand alone. Behind the gun captain in his turret, the quartermaster on the bridge, the water tender below, stand a host of invisible comrades. They are machinists, electricians, puddlers. They are gunsmiths, chemists, foundrymen. They are the workers who built the ships and the engines, the armor and the guns. They are you—and millions like you. Though invisible, you are there.

"For it is upon your skill and honest workmanship that our fighting seamen must depend when the time comes. Will our armor stand up under punishment? Will our guns shoot straight and hit hard? . . . Your work will tell the story. And it is a story that will be told not only in the lives and deaths of your friends and countrymen in the battle line. It is a story greater even than that of victory or defeat for our fighting fleet. For these things are symbols of something larger still: The survival of our country itself and all it stands for. . ."

Significance of Special Compilations of A.S.T.M. Standards

While each A.S.T.M. publication is intended to make available in convenient form pertinent information and data on materials, if we were to be asked what particular group of books seemed outstanding in the Society's publication schedules, eliminating from consideration our Book of Standards and *Proceedings*, we would unhesitatingly point to the special compilations of standards. In 1941, eight of these compilations were issued as indicated below.

Three additional books are on a biennial basis, the compilations covering coal and coke, refractories, and paint, varnish, and related materials, last published in 1940. The volumes are issued to provide in more convenient form than offered by the Book of Standards, all A.S.T.M. specifications and tests in the specific field covered, and they are made available at a reasonably nominal cost. Several of the books include considerable material not published elsewhere (technical papers, tables of data, etc.) which is pertinent primarily in the specific field covered.

From the tabulation given below it can be seen that some of these books are quite extensive. Three were issued for the first time in 1941, covering copper and copper alloys, mineral aggregates, and electrical heating and resistance alloys. While these special compilations are significant to the user because of convenience and utility, perhaps of most significance is their beneficial effect in promoting knowledge of the Society and stimulating a use of A.S.T.M. specifications and tests. Some idea of the distribution can be gained from the tabulation showing the number of copies printed, since the editions are gaged as closely as possible to demand.

Title	Edition	Number of Stds.	Pages	List Price	Members' Price
1941 Compilations					
Electrical Heating and Resistance Alloys	750	19	103*	$1.25	$1.00
Copper and Copper Alloys	1200	71	360	2.00	1.50
Cement	2000	9	103	1.00	0.75
Mineral Aggregates	1000	44	140	1.25	1.00
Petroleum Products and Lubricants	5000	82	406	2.00	1.50
Electrical Insulating Materials	750	52	450	2.25	1.75
Rubber Products	1200	39	288	1.75	1.25
Textile Materials	1600	68	399	2.00	1.25
1940 Compilations					
Coal and Coke	1500	28	131	1.25	1.00
Refractories	2500	26	181	1.50	1.15
Paint, Varnish, and Related Materials	1500	103	353	2.00	1.50

* First 500 copies included copy of special technical paper, comprising an additional 36 pages.

Some Data on the Air Content of Freshly Mixed Concrete

By J. C. Pearson[1] and H. G. Collins[1]

The increasing use of cements containing Vinsol resin and other water-repellent admixtures, the majority of which produce concretes having relatively large quantities of entrained air, has created a growing interest in quantitative determinations of the air content in such mixtures.

The volume of the entrained air in a given volume of concrete is the difference between the total over-all space occupied by the concrete and the sum of the absolute or solid volumes of all its constituents other than air. From the known weights of cement, aggregate, and water, and their respective specific gravities, solid volumes may be readily computed. This procedure is the one that has been commonly used for the calculation of the air voids in freshly placed concrete.

Unfortunately a discrepancy no greater than 2 per cent in the specific gravity of the aggregate may introduce as much as 50 or 100 per cent of error in the air determination, depending upon the quantity of air actually present. Errors of 1 or 2 per cent in the specific gravity of the aggregate may easily occur in a majority of cases. Most gravel aggregates, for example, contain a variety of minerals, among which specific gravities may vary over quite a range and the specific gravity of a given sample may not be representative of that for the lot. Differences in the absorbed moisture content of the sample, if not correctly taken into account, may also introduce appreciable error.

To illustrate, assume that the batch is to be mixed from saturated surface-dry aggregate for which the absorption is 1 per cent. For 1000 g. dry weight (*A*), the saturated weight will be 1010 g. (*B*). Assume that the immersed weight of the saturated aggregate is 623 g. (*C*). Then according to A.S.T.M. Standard Method of Test for Specific Gravity and Absorption of Coarse Aggregate (C 127 – 39),[2] the apparent specific gravity $= \frac{A}{A - C} = \frac{1000}{377} = 2.65$ and the bulk specific gravity $= \frac{A}{B - C} = \frac{1000}{387} = 2.58$.

Neither of these values should be used in the calculations, however, since the 1000-g. sample of dry material weighs 1010 g. as batched and the bulk specific gravity of the saturated material is $\frac{B}{B - C} = \frac{1010}{387} = 2.61$.

To avoid the use of specific gravities in the air determination a method for the quantitative determination of air in concrete was proposed by the authors in 1936.[3] This method was rewritten and presented in 1940 to Subcommittee VII on Methods and Apparatus for Testing Concrete of the A.S.T.M. Committee C-9 on Concrete and Concrete Aggregates in 1940 for acceptance as a tentative method.

The "bulk" volume of the concrete is first determined according to the method described in the A.S.T.M. Standard Method of Test for Yield of Concrete (C 138 – 39)[4]; then a representative sample is transferred to a pycnometer, or weighing pot, the air displaced by flooding the concrete with water, and the volume of the concrete without the entrained air determined by subtracting the volume of water required to fill the pycnometer from the volume of the latter. With calibrated apparatus, the measurements are quite accurate, the technique simple, and no knowledge of specific gravities or absorptions is required. The chief uncertainty involved is the effect of the further reaction between cement and water, after dilution of the concrete sample with a large addition of water, but there is rather convincing evidence to show that this effect is small, and negligible in the practical problem.

The foregoing method, which for later convenience may be referred to as the "hand" method, was quite thoroughly tested in a considerable variety of mortar and concrete mixtures, but without critical inquiry as to how completely the process of rolling and shaking the concrete in the pycnometer would remove the air from the perceptibly foamy mixtures produced with treated cements. Accordingly it seemed desirable to make further tests in which the hand method was supplemented by a vacuum treatment which could be expected effectively to remove the air from the diluted concrete.

Equipment for Vacuum Treatment

The arrangement for applying the vacuum treatment is shown in Fig. 1. The pycnometer, *P*, is a brass cylindrical pot about 5 in. in diameter and 14 in. high, fitted with a quickly removable air-tight cover, *C*. This cover has a small tube outlet close to the wall of the pot, connected by a 27-in. length of rubber tubing, *T*, to an ordinary milk bottle, *B*, which serves as a trap. The bottle *B* is clamped firmly to the table by a simple holder not shown in the diagram. A short tube closed with a clamp, *Cl*, through the stopper of *B* is convenient for admitting

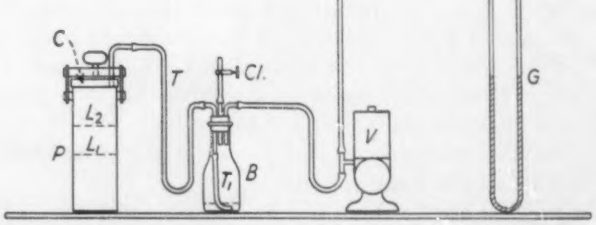

Fig. 1.—Method of Applying Vacuum to Pycnometer for Removal of Air from Concrete.

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Director of Research, and Concrete Engineer, respectively, Lehigh Portland Cement Co., Allentown, Pa.

[2] 1939 Book of A.S.T.M. Standards, Part II, p. 300.

[3] J. C. Pearson and H. G. Collins, "A Method for Determining the Air Content of Freshly Mixed Mortars and Concretes," *Proceedings*, Am. Concrete Inst., Vol. 32, p. 298 (1936).

[4] 1939 Book of A.S.T.M. Standards, Part II, p. 344.

TABLE I.—SUMMARY OF TESTS FOR AIR IN CONCRETE.

Test [a]	Date 1941	Cement, Type	Sacks per Yard	Gallons per Sack	Slump, in.	Air, per cent		Density of Concrete	
						Hand Method	Vacuum Method	Hand Method	Vacuum Method
Nos. 1 & 5	7/29–31	II + Vinsol	6.7	5.5	4	3.52	3.61	2.393	2.398
No. 6	7/31	Masonry	10.3	5.3	8 (?)	9.41	...	2.199	...
Nos. 7 & 9	8/5	I	6.0	6.0	3 to 4	1.36	0.98	2.389	2.386
Nos. 10 & 11	8/5–6	II + Vinsol	5.9	6.1	2 to 3	4.25	3.47	2.395	2.396
Nos. 12 & 14	8/6	I + 1/6 Masonry	5 + 1	6.0	4 to 5	2.11	1.77	2.390	2.387
Nos. 27 & 28	8/13	Masonry	7.3	5.2	3 to 4	3.51	4.40	2.336	2.357
No. 29	8/13	Masonry	7.3	5.2	3 to 4	...	4.21	...	2.346
Nos. 30 & 31	10/3	II + Vinsol	7.9	6.8	7 (?)	10.3	10.7	2.256	2.266
No. 32	10/6	II + Vinsol	6.1	5.4	3 to 4	...	4.0	...	2.316
No. 33	10/7	II + Vinsol	7.3	5.0	3 to 4	...	4.3	...	2.322
No. 34	10/7	II + Vinsol	4.9	8.0	3 to 4	...	6.75	...	2.350
Nos. 35 & 36	10/14	II + Vinsol	4.9	8.0	3 to 4	7.10	6.01	2.357	2.365
Nos. 37 & 38	10/16	II + Vinsol	4.9	8.0	3 to 4	6.85	6.68	2.357	2.364
Nos. 39 & 40	10/17	II + Vinsol	4.9	8.0	3 to 4	6.75	7.40	2.354	2.362
Nos. 41 & 42	11/25	I + Vinsol	6.0	5.7	3	5.55	5.95	2.400	2.406
Nos. 43 & 44	11/25	II + Vinsol	6.0	5.9	3	3.69	3.52	2.395	2.390
No. 45	11/25	I + 0.015% Al	6.5	6.2	6	2.53	...	2.380	...
No. 45(a)	11/25	I + 0.015% Al	6.3	6.2	...	5.4	...	...	...

[a] Nos. 6, 30, and 31 were 1:3 mortars of graded Ottawa sand; Nos. 34 to 40 were pebble concretes of 3/8 in. to No. 4 pebbles and fine sand; all others were concretes of Delaware River sand and gravel 3/4 in. maximum size.

air to the system after the test. The outlet from the trap *B* is connected to the pump *V* and a mercury U-gage, *G*.

In operation, the pot *P* is filled, say to the level L_1, with about 4000 g. of concrete, and after its weight is accurately determined 700 or 800 ml. of water are added, say to the level L_2. The pot is then closed with a cover similar to *C*, but without the tube attachment, and the concrete and water are mixed by shaking and rolling. The closed cover is next removed and adhering solids are rinsed back into the pot. The cover *C* is then applied as shown in the diagram, and the pump started. The pycnometer is now laid in inclined position on the table by resting the bottom edge on the table, while the upper part of the cylinder rests on a bar or strip of wood an inch or more thick. The outlet tube is kept near the highest point of the cylinder, so that the liquid level is below the outlet, and the cylinder and its contents are then kept in motion by rolling the cylinder back and forth through an angle of about 90 deg. This procedure prevents any considerable amount of water passing into the tube *T*, but the cement-bearing foam boils up in the pot under the reduced pressure, and a considerable quantity of this may pass over into tube *T*, discharging into the trap through tube T_1. This tube discharges under water, and if there are no leaks in the system up to that point the removal of air from the concrete can be watched and the end point determined. If there is a slight leak, then the end of the entrained air removal is indicated when bubbles discharge from T_1 at regular intervals. The pump used in these experiments is capable of giving a vacuum of about 29 1/4 in. of mercury, and it has been our practice to apply the vacuum for a period of 10 min., with little evidence of air removal after 5 to 7 min.

At the end of the vacuum treatment the pump is stopped and air admitted to the system by loosening the clamp *Cl*. This sweeps most of the water in *B* back into *P*; the stopper is then removed from *B*, and elevating the tubes T_1 and *T*, the adhering solids are rinsed back into the pot. The cover *C* is then rinsed into the pot, and finally the solids in *B* are also returned to the pot. In this manner none of the solids is lost, and the gaging of the pot and the remainder of the operation are carried out as described in the hand method.

If there is any considerable amount of foam left in the pot after the vacuum treatment as described above, it is advisable to wash the cement out of the foam by spraying water upon it from a fine spray nozzle. In fact, this is an essential part of the operation when the vacuum treatment is not used and when copious amounts of stable foam persist after the rolling and shaking of the inundated concrete. Not only does this spraying of the foam prevent loss of cement, but it reduces the volume of the foam to small amounts that can be readily removed prior to the gaging operation.

Results of Tests

In Table I are given some of the test results obtained by the hand method and by the vacuum treatment.

In Table I the missing test numbers were in most cases specific gravity tests of cements and aggregates, and are omitted as having no bearing on the data presented. The type of cement used, cement factor, water-cement ratio, and slump are recorded for each entry as indicating the type of mixture tested. The percentage of air and the measured density of the concretes are given both for the hand method and the vacuum method of treatment.

In regard to densities, the values are recorded to the third decimal place, but there is no intent to imply that these are known to that degree of accuracy—the method should, with careful manipulation, give results reproducible to 5 in the third place, or better. Since it is evident that a given percentage error in density of the concrete gives rise to the same percentage error in the air content, and since an error of 0.005 in the former is approximately 0.2 per cent, this latter figure represents about the degree of accuracy to be expected in the air determination.

Experience shows, however, that the air entrained in filling, say, a 0.1 cu. ft. measure of concrete cannot, in general, be expected to repeat itself in successive tests as closely as 0.2 per cent—in mixtures of relatively high air content, the latter may easily vary as much as 1 per cent or more, even when the measure is filled with concrete by the standard procedure. Hence computation of the density of the concrete for each air determination serves a useful purpose in indicating whether the air has been completely removed. Thus in Table I, in tests Nos. 7 to 14, the close agreement in densities of the concrete by the hand and vacuum methods indicates that the variations in air content are real differences. On the other hand, the slightly higher densities of concrete from the vacuum method in tests Nos. 35 to 42 indicate that this method

tends to remove a little more air than the hand method, although the differences are small and sometimes reversed, as in tests Nos. 43 and 44.

Attention may be called especially to test No. 45, which was a test of normal cement concrete containing 0.015 per cent aluminum powder. By the hand method an air content of 2.53 per cent was determined. However, when a 0.1 cu. ft. measure of this concrete was left standing for 1 hr., the concrete expanded from the internal generation of gas, and enough concrete was removed from the top to leave the measure exactly filled. The density of the concrete was then found to be lowered by 2.9 per cent, and this added to the air content originally determined gave the data recorded under 45 (*a*).

Concretes made entirely with masonry cement (Nos. 27, 28, 29) gave trouble from scum and excessive foaming, and this was true also of certain masonry mortars. The latter were troublesome even with the vacuum treatment, indicating that air determinations in mortars containing relatively large amounts of soap-forming admixtures will be subject to somewhat larger error than those in concrete mixtures.

Since the data presented herewith were obtained, a volumetric method with vacuum treatment has been described by Pigman of the Bureau of Standards.[5] So far as one may judge from this paper, a relatively high degree of accuracy is obtained in the air determinations, but the author shows considerable variations in repeat tests, which seem to confirm the experience reported above, namely, that the air determinations by either the hand method or the vacuum methods are more certain than the probability of entraining the same amount of air in repeated placings of a given concrete. If this is the case in laboratory operations, it is likely to be more noticeably so in field operations, and therefore a simple and reasonably precise method for determining the air content seems preferable to one which involves more equipment and a more involved technique, even though the accuracy of the vacuum methods may be somewhat higher. Therefore, on the basis of available data and experience the "hand" method has been recommended to Subcommittee VII of Committee C-9 for consideration as a tentative method of the Society. Regardless of what action is taken by the committee, it is felt that this "progress report" may be of interest to users of concrete made with treated cements.

[5] G. L. Pigman, "A Vacuum Method of Measuring the Air Content of Fresh Concrete," *Journal*, Am. Concrete Inst., Vol. 13, No. 2, November, 1941, p. 121.

Extensive 1941 *Proceedings* Completed

Distribution of the 1941 *Proceedings* of the Forty-fourth Annual Meeting to each member of the Society and purchasers has been completed.

This volume of some 1400 pages is arranged in two sections covering technical committee reports and appended material, and secondly, the technical papers presented at the Society's annual meeting.

This volume is one of the very tangible assets of affiliation with the Society and represents infinitely more than printing, paper, and binding. While the mechanics of producing the volume—editing the papers and reports, etc.—have been pretty much mechanized at A.S.T.M. Headquarters, any book of 1400 pages entails a tremendous amount of effort. In the case of *Proceedings*, this has been contributed by a great number of technical men and engineers who prepared the committee reports, checked them and brought them up to date after actions at the annual meeting. The authors of the technical papers also from a great many branches of industry have each expended many hours of effort in preparing the contributions which would meet the high standards set up by the A.S.T.M. Papers Committee. It is no reflection on authors to remark that much time is expended in condensing and boiling down. Even with 1400 pages, there is little space available for redundancy and irrelevant material.

Broadly, the *Proceedings* represent the two basic phases of A.S.T.M. work—standardization and research. The committee reports cover details of standardization effected during the year and with the technical papers afford a great wealth of important engineering data on the properties and tests of materials. The most extensive and well planned research program is of little avail unless the results can be set down and to be of maximum benefit they should be readily available. This is the chief purpose of any publication akin to the A.S.T.M. *Proceedings*.

No attempt is made here to present a so-called review of this latest volume, but two points might be worth comment: (1) The published volume affords members the first opportunity to review several technical papers which it was not possible to preprint in advance of their presentation at the annual meeting. Frequently some of these papers may be extremely significant in the field covered. Included among a list of such contributions which were not preprinted or which have not since been published in the ASTM Bulletin are the following:

- Resistance of Plastics to Chemical Reagents—G. M. Kline, R. C. Rinker, and H. F. Meindl
- A Study of the Grindability of Coal and the Fineness of Pulverized Coal when Using the Lea-Nurse Air Permeability Method for Evaluating the Subsieve Fractions—J. B. Romer
- The Effect of Carbide Spheroidization upon the Creep Strength of Carbon-Molybdenum Steel—S. H. Weaver
- Compression and Tension Tests of Structural Alloys—Bruce Johnston and Francis Opila
- Methods of Testing Volumetric Glassware—J. J. Moran
- An Accelerated Atmospheric Corrosion Test—H. Pray and J. L. Gregg
- Properties of Limes and Lime-Mortars—Howard R. Staley
- Discussion of the Dynamic Methods of Testing Concrete with Suggestions for Standardization—Leonard Obert and W. I. Duvall
- The Effect of Fine Aggregate on the Durability of Mortars—C. A. Hughes and Kenneth A. Andersen

The second point we would stress is the great amount of very interesting discussion which appears in the volume. This, of course, from its very nature could not be preprinted. Comments by other engineers on specific points raised by an authority may be corroborative or challenging in nature and frequently may bring out points as significant in some respects as those in the paper being discussed.

An important part of the 1941 *Proceedings* is the Symposium on Problems and Practices in Determining Steam Purity by Conductivity Methods comprising seven extensive technical papers. This symposium is also being published in separate pamphlet form.

In a volume of this size an index is most essential and the customary detailed attention has been devoted both to the subject and author indexes so that material may be located efficiently.

Each member of the Society receives a cloth bound copy of this book. Copies can be procured in half-leather binding at the extra cost of $1. Members who wish to purchase extra copies can do so at the special members price of $6 in cloth; the list price to nonmembers is $9.

New Book on "Standardization Activities of Technical and Trade Organizations"

A PUBLICATION entitled "Standardization Activities of National Technical and Trade Organizations" has just been issued through the work of the National Bureau of Standards. This book, prepared by Robert A. Martino, will undoubtedly be of interest to many A.S.T.M members and those concerned with standards. The book describes the standardization and simplification movement carried on by various organizations in the United States. It outlines the work of some 450 societies and associations in which standardization is a major or important phase or activity, and special attention has been given to the cooperation of these groups with the leading technical bodies whose principal activities are in the field of standardization.

Following a brief introduction by the author outlining the scope of the publication, there is a chapter covering four general standardizing agencies—American Standards Association, Central Committee on Lumber Standards, National Aircraft Standards Committee, and American Society for Testing Materials. The major portion of the volume is the third section covering some 210 pages, on various societies and trade associations. This section covers especially current standardization programs, accomplishments, methods of appointing committees—their authority and functions, with information on methods used to make the standards and specifications effective in the industry.

There is an interesting condensed section covering the functions and activities of the National Bureau of Standards and the Procurement Division of the U. S. Treasury Department, particularly its work in preparing Federal and Procurement Division specifications. A 23-page bibliography on standardization is a valuable part of this new book and a detailed 22-page index completes the publication.

Copies in blue buckram binding can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 75 cents each. Purchase of this 292-page book by all engineers and technologists concerned with standards and specifications work is recommended.

Condensed Chemical Dictionary

THE THIRD EDITION of the Condensed Chemical Dictionary makes available a convenient, comprehensive, and up-to-date listing of information relating to all types of chemical products and raw materials. More than 18,000 items are included, an increase of approximately 6000 items over the Second Edition. The items added include descriptions of new chemicals, a greatly increased number of listings of "chemical specialties" under their trade or brand names, and informational items (such as the very interesting article on vitamins). Synthetic fibers, synthetic rubber, and other such products which have become of increased interest because of the present emergency are covered.

Information on chemical and physical properties, derivations, grades, uses, containers in which the material is available, and railroad shipping regulations is given for the various chemical products and raw materials and has been brought up to date for the items retained from the Second Edition.

A new feature, which should be most useful, is the inclusion under many of the items of "Typical Specifications" which represent a description of the product as marketed and sold commercially.

Newly added sections of the book are "A Guide to the Pronunciation of Chemical Names" and a tabulation showing the effect of wartime on prices of chemicals, during World War I, and from July 3, 1939, to October 10, 1941.

Comprising nearly 800 pages, thumb-indexed for easy reference, this publication represents an excellent source of chemical information. It is available in cloth binding from the Reinhold Publishing Corp., 330 W. Forty-second St., New York, N. Y., at $12 per copy.

"The Laboratory Glass Blower"
Honorable Mention, Nonprofessional, in the Fourth A.S.T.M. Photographic Exhibit, by W. C. Wilke, Crane Co.

Terminology Relative to Volume and Specific Gravity of Granular Materials for Concrete

By Lewis H. Tuthill[1]

SYNOPSIS

Confused current terminology relative to volume and specific gravity is tabulated and reviewed. A logical selection of terms is discussed and submitted for consideration as a start toward establishing an acceptable recognized standard terminology through action of appropriate committees.

During the growth of the literature of concrete through the past fifty years there has developed a certain amount of confusion in the terminology relative to volume and specific gravity. These physical conceptions are so fundamental, and discerning descriptive terminology for them is so necessary to orderly computation and discussion of concrete materials and mixes, it seems worth while to review the situation and perhaps lay the ground work for formal official consideration of a suitable standard nomenclature before the matter becomes further complicated.

In concrete we are primarily concerned with what is apparently the volume within the surface of each particle or piece of solid material, regardless of internal voids or porosity, because each will occupy that volume in the mixture. Our selected wording descriptive of this particular conception of volume, and of specific gravity on this basis, should avoid conflict, if possible, with proper terms descriptive of volume in use in other technical fields. Furthermore, it would seem most appropriate and a further aid to simplification if the same adjectives were adopted for both volume and specific gravity on a given basis, since by definition specific gravity is so intimately related to the volume. Thus, for instance, we would have bulk volume and bulk specific gravity, apparent volume and apparent specific gravity, absolute volume and absolute specific gravity, etc. Certainly it would seem difficult to justify such inconsistencies as the use of the term "bulk" specific gravity in reference to "absolute" volumes of materials,[2,3] although the literature abounds in such contradictory usages. Use of "apparent" specific gravity to determine "absolute" volume has been common.

In Table I the present synonymous and sometimes conflicting terminology is summarized, and the suggested terms are selected on the basis of the accompanying literal definitions of the words as they serve our purpose. These terms are thus shown to have an initial measure of suitability in their common English meaning. Although these terms admirably clarify this situation for the writer, it is recognized they may not be so acceptable to others, and for this reason it is emphasized that they are submitted only as a suggestion for a starting point in further consideration and discussion.

As indicated in Table I, there are several conceptions of the volume of granular material which require definition. These range from the largest space the material may occupy in a bin to the irreducible volume of the solid portion.

The maximum-volume condition of granular material is the over-all bulk of the material, or the space occupied in a bin or container when the material is dumped loose and has no consolidation. Cement in this condition not in sacks we speak of as "bulk" cement. When a volume of sand becomes greater from handling in a moist condition, the increase is due to "bulking." Such a unit as the bushel is most descriptive of this type of volume. "Loose bulk" volume therefore seems an appropriate and descriptive term, although, of course, the cubic foot would be used as the unit of measure. The weight per cubic foot of material on this basis divided by 62.4 would give a corresponding bulk specific gravity.

When the loose bulk volume is consolidated by dry-rodding, jigging, or vibration, so as to occupy a comparatively minimum over-all space in a container, this may be called consolidated bulk volume. It has been commonly and descriptively called the dry-rodded volume, but this term is limited to one means of compaction. Since the volume varies with the means of consolidation, it is necessary to state the means of consolidation in batch computations using this basis of volume. Consolidated bulk volume is a minimum form of bulk volume and is literally dry-rodded or otherwise compacted bulk volume. In the days when mixes were designed and proportioned on the basis of volume inclusive of the voids among the particles, discriminating engineers realized that a comparatively uniform volume basis was necessary in view of the variable degree of bulking of the different materials, particularly the sand, depending on their handling and moisture content. The result was the use of an over-all volume measurement in which the voids among the particles were comparatively reproducible and relatively near the minimum. Usually it was called dry-rodded volume because standards were established for that form of consolidation in 1920 in A.S.T.M. Method C 29.[4] Factors for the particular bulking encountered were applied. As for loose bulk volume, the specific gravity of consolidated bulk volume is seldom required, the unit weight being sufficient for most purposes. It is equal to the weight per cubic foot of the compacted material divided by 62.4 and may be called consolidated bulk specific gravity. With the general advance of the concrete industry to proportioning on the weight basis, loose bulk volume and consolidated bulk volume and the corresponding specific gravities have little further use to concrete engineers, but they are included briefly to round out the range of volumetric conceptions.

As previously mentioned, now that weight batching is

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[1] Concrete Engineer, Bureau of Reclamation, Denver, Colo.

[2] Ivan F. Waterman, "Design of Concrete Mixes," *Concrete*, November, 1937, p. 14.

[3] G. E. Troxell and H. E. Davis, "The Making and Testing of Plain Concrete," pp. 60, 123, Stanford University Press (1938).

[4] See the rodding procedure described in Section 5 of the Standard Method of Test for Unit Weight of Aggregate (C 29 – 39), 1939 Book of A.S.T.M. Standards, Part II, p. 308.

TABLE I.—TERMINOLOGY RELATIVE TO VOLUME AND SPECIFIC GRAVITY OF GRANULAR MATERIAL.

Suggested Descriptive Terms			Various Terms Used[c]	
For Volume	For Specific Gravity[a]	Definitions of Adjectives[b]	For Volume	For Specific Gravity
Loose bulk volume (moist or dry) *Including* bulked voids among particles	Loose bulk specific gravity (Unit weight is more common than specific gravity for volume on this basis) $\text{Sp. gr.} = \frac{\text{Unit wt.}}{62.4}$	Bulk "A heap or pile; cargo, etc., lying loose; the *whole space* for storing goods; to swell or expand"	Bulk (*10*) Loose measured (*10*) Loose moist (*14*) Loose and damp (*21, 24*) Damp loose (*26*) Dry loose (*26*)	Bulk (*20*) Apparent density (*2*)
Consolidated bulk volume (dry) *Including* an approach to minimum voids among the particles. (Voids will vary slightly depending on whether material is consolidated by vibration, jigging, or rodding)	Consolidated bulk specific gravity Unit weight is more common than specific gravity for volume on this basis) $\text{Sp. gr.} = \frac{\text{Unit wt.}}{62.4}$	Consolidated "To bring together compactly; unite"	Bulk (*8*) Aggregate (*10*) Dry rodded (*10, 14, 15, 18, 20, 24, 26*) Dry and rodded (*16*) Dry and compacted (*21*) Apparent (*1*)	
Apparent volume *Excluding* voids among particles *Including* all voids within particles. (The volume within the surface of the particles; the volume of concrete displaced by them) includes permeable & impermeable voids	Apparent specific gravity (1) Dry basis (2) Wet (saturated surface-dry) basis $\text{Sp. gr. (1)} = \frac{A}{B - C}$ $\text{Sp. gr. (2)} = \frac{B}{B - C}$ Called B.S.G. by ASTM	Apparent "*Appearing; to all appearance;* ostensible; also seeming (as opposed to 'actual' or 'real')"	Apparent (*6, 7, 9, 10, 14*) Apparent absolute (*20*) Absolute (*1, 3, 4, 8, 9, 12, 13, 14, 18, 19, 21, 23, 24, 26, 27*) Solid (*13, 25, 26*) Actual (*1, 3, 10, 22*) Net (*3*) Displacement (*26*) Occupied (*22*) Elementary (*4*)	Apparent (*5, 9, 10, 12, 16, 17, 20, 21, 22*) Bulk (*11, 22, 23, 24*)
(No term suggested) *Excluding* permeable voids *Including* impermeable voids Volume and specific gravity on this basis serve no useful purpose and should be omitted from standard terminology to avoid such confusion as they have already caused	(No term suggested) $\text{Sp. gr.} = \frac{A}{A - C}$	Impermeable "Not permeable, not permitting the passage of fluid; impenetrable; impervious"	Absolute (*6, 7, 20, 22*) Solid (*7*)	True (*5, 20, 22*) Absolute (*6*) Apparent (*11, 22, 24*)
Absolute (solid) volume Excluding *all* voids and sometimes referred to vacuum	Absolute specific gravity (Solid ground to fine powder for specific gravity test and some times referred to vacuum) $\text{Sp. gr.} = \frac{A}{A - C}$ $\text{Sp. gr.} = \frac{A'}{A' - C'}$	Absolute "Free from restriction or limitation; unqualified; independent of arbitrary standards" Solid "Free from cavities, or not hollow, not porous; filling the whole space occupied by its *apparent* volume"	Absolute (*10*) Solid (*10*)	Absolute (*2, 11*)

[a] The letters A, B, and C represent: the weights in air of the sample, dry (A) and saturated surface-dry (B), and the weight of the saturated sample in water (C). A' and C' are corresponding values when referred to vacuum.
[b] Applicable phrases and synonyms from the Century, New International, and New Standard Dictionaries and Roget's Thesaurus.
[c] The italic numbers in parentheses refer to the reports and papers appearing in the list of references.

REFERENCES IN WHICH VARIOUS TERMS SHOWN IN TABLE I ARE USED

(*1*) René Feret, "Annales des Ponts et Chaussées," pp. 30, 52, 60, France Commission des Annales des Ponts et Chaussées, Paris (1892).

(*2*) Commission des Methods d'Essais des Materiaux de Construction, Tome IV, pp. 309, 338 (1894).

(*3*) W. B. Fuller and Sanford E. Thompson, "Laws of Proportioning Concrete," *Transactions*, Am. Soc. Civil Engrs., Vol. 59, December, 1907, p. 85.

(*4*) René Feret, Discussion of paper by W. B. Fuller and Sanford E. Thompson, "Laws of Proportioning Concrete." *Transactions*, Am. Soc. Civil Engrs., Vol. 59, December, 1907, p. 152.

(*5*) Standard Method of Test for Apparent Specific Gravity of Coarse Aggregates (D 30 – 18), 1933 Book of A.S.T.M. Standards, Part II, p. 994.

(*6*) G. A. Hool and N. C. Johnson, "Concrete Engineer's Handbook," p. 28, McGraw-Hill Book Co., Inc., New York, N. Y. (1918).

(*7*) M. O. Withey and James Aston, "Johnson's Materials of Construction," pp. 403, 409, 412, John Wiley and Sons, Inc., New York, N. Y. (1919).

(*8*) A. N. Talbot, "Proportioning Concrete by Voids in Mortar," *Engineering News-Record*, Vol. 87, July 28, 1921, p. 150.

(*9*) A. N. Talbot and F. E. Richart, "The Strength of Concrete," *Bulletin No. 137*, Vol. 18, pp. 16, 19 (1923).

(*10*) J. A. Kitts, "Making Concrete on the Exchequer Dam Project," *Western Construction News*, Vol. 2, January 25, 1927, p. 44.

(*11*) Standard Definitions of Terms Relating to Specific Gravity (E 12 – 27), 1939 Book of A.S.T.M. Standards, Parts II and III.

(*12*) F. H. Jackson, "The Design of Pavement Concrete," *Public Roads*, Vol. 9, August, 1928, p. 127.

(*13*) Editorial, *Concrete Highways Magazine*, Vol. 12, December, 1928, p. 1.

(*14*) J. A. Kitts, "The Absolute Basis of Proportioning," *Proceedings*, Am. Concrete Inst., Vol. 25, p. 741 (1929).

(*15*) A. G. Darwin, "The Yield of Certain Concrete Mixes," *Concrete*, Vol. 38, July, 1930, p. 31.

(*16*) Stanton Walker, "Effects of Grading of Gravel and Sand," *The National Sand and Gravel Bulletin*, Vol. 11, September, 1930, p. 7.

(*17*) Tentative Method of Test for Apparent Specific Gravity of Coarse Aggregates in a Saturated Condition (C 86 – 31 T), 1935 Book of A.S.T.M. Tentative Standards, p. 612; *Proceedings*, Am. Soc. Testing Mats., Vol. 31, Part I, p. 766 (1931).

(*18*) J. E. Buchanan, "Proportioning Concrete Mixes," *Western Construction News*, Vol. 7, February, 1932, p. 42.

(*19*) Inge Lyse, "Simplifying Design and Control," *Engineering News-Record*, Vol. 108, February 19, 1932, p. 249.

(*20*) J. C. Sprague, "Basic Steps in Control of Concrete," *Concrete*, Vol. 42, May 1, 1934, p. 17.

(*21*) "Design and Control of Concrete Mixes," Portland Cement Assn., 1931 and 1936 Editions, p. 18.

(*22*) J. C. Sprague, "Inter-Relationship Between Physical Characteristics of Concrete Aggregate," *Rock Products*, Vol. 40, March, 1937, p. 64.

(*23*) Ivan F. Waterman, "Design of Concrete Mixes," *Concrete*, Vol. 45, November, 1937, p. 14.

(*24*) G. E. Troxell and H. E. Davis, "The Making and Testing of Plain Concrete," pp. 60, 123, Stanford University Press (1938).

(*25*) "Concrete Manual," Bureau of Reclamation, January, 1941, p. 119.

(*26*) "Manual of Concrete Inspection," Committee 611, Am. Concrete Inst., p. 50 (1941).

(*27*) "Design of Concrete Mixes," Committee 613, *Journal* of the Am. Concrete Inst., Vol. 13, January, 1942, p. 193.

prevalent, in computation of concrete mixes we are no longer directly concerned with the voids among the particles of solid material in the mixture. We are concerned rather with the space each individual particle will occupy in the concrete and with the sum of the volumes of the individual particles, and we must therefore describe the volume of the solid material on this basis. This is the summation of the volumes of material apparently existing within the surface of the particles. This volume for the above reason has been called the apparent volume by a number of authorities and, to the author, for reasons which will be discussed, this seems the most appropriate of the various terms which have been used. It is suggested therefore as the most desirable of them for official adoption unless a more suitable term can be found.[4] It is to be noted, according to the above definition, that the apparent volume of an aggregation of granular materials after drying is the same as when it is in a saturated, surface-dry condition. It is the sum of the apparent volumes of the individual particles and excludes the voids which exist among particles in a bulk condition but includes all the voids within the particles themselves.

For the volume just described as applied to the individual particles there have come into use such terms as "solid" and "absolute," whereas "bulk" is used to describe specific gravity on this basis. These terms are so much in conflict with the fact and with each other, and are so ideally suited for other concepts of volume, that it is difficult to see how they have reached their current popularity. Where use of these terms may be found in the literature is indicated in Table I and will not be enumerated in detail. The following cases, however, are of particular interest.

Talbot and Richart[5] use the term "absolute" volume to denote the volume bounded by the surfaces of the particles; and yet, after describing how specific gravity on this basis is found, they state, "It should be noted that in all cases apparent specific gravity was found. That is, the volume of a particle was taken as the space bounded by its surfaces, thus including the interior pores of the material." Why they use the term "absolute" for the volume after such an excellent definition of apparent volume in correctly naming the apparent specific gravity is not clear, except perhaps "absolute" may have seemed to them more graphic in relation to the loose-moist and dry-rodded volumes commonly referred to in discussing concrete-aggregate volumes. The same reason perhaps applies to Kitts' use of the word "absolute,"[6] although he points out in a footnote that "absolute volume, as used herein, denotes apparent volume, as generally termed by concrete physicists, and is the volume within the surface of the particles."

If apparent volume as above defined were the most irreducible type of volume, it would be appropriate to call it absolute volume. Because it is not, and a suitable term must be provided for the most irreducible type of volume, whether it is to be used in connection with concrete or not, such an unqualified term as "absolute" should be restricted to the unqualified, irreducible type of volume. The term "solid" although not so definite as "absolute" carries much the same implication—that of ignoring voids within the surface of each particle. Other terms are not used sufficiently to merit discussion.

In concrete work, apparent specific gravity, as above defined by Talbot and Richart, is necessarily qualified by two conditions of test, since aggregate may be wet or dry, although the former is by far the more common. With wet aggregate, the apparent specific gravity on the saturated surface-dry basis is used in the computation of concrete mixes and proportions. On the saturated surface-dry basis, the apparent specific gravity is influenced by the weight of water in the pores of the rock. On this basis,

$$\text{Apparent Specific Gravity} = \frac{B}{B-C}$$

where: B = weight of the saturated surface-dry sample in air, and
C = weight of the saturated sample in water.

It is to be noted that "apparent" specific gravity on this basis of volume in a saturated surface-dry condition was formerly recognized in C 86 – 31 T.[10]

With dry aggregate, the apparent specific gravity on the dry basis is used. This is a slightly lower value for the same material because the pores are not filled. On the dry basis,

$$\text{Apparent Specific Gravity} = \frac{A}{B-C}$$

where: A = weight of the dry sample in air,
B = weight of the saturated surface-dry sample in air, and
C = weight of the saturated sample in water.

The term "bulk" specific gravity for apparent specific gravity of concrete materials has came into use since its acceptance for this purpose in 1936 in Method C 127.[7] This term was first promulgated for apparent specific gravity in 1925 in Definitions E 12.[8] The volume of material described is "a given volume of a permeable material (including both permeable and impermeable voids normal to the material)." If "permeable" refers only to the voids within and not to those among the particles, the volume described is the same as that bounded by the surface of the particles, or apparent volume. Regardless of the existence of this definition in Definitions E 12,[8] various standards for tests of specific gravity (Methods D 30,[9] C 86,[10] and C 97[11]) continued for many years to use the term "apparent"

[4] It is recognized that there is need for a better word than "apparent" to describe volume and specific gravity on this basis on account of some imperfection in distinction from bulk volume and certain conflict with usage in fields foreign to concrete, but so far no better term that is consistent has been suggested. More exactly we mean "apparently solid" volume and specific gravity on the basis of "apparently solid" volume. Perhaps "apparently solid" is the term we are looking for. Certainly it is more accurate than "solid" or "absolute," although "solid" is preferable to "absolute."

[5] A. N. Talbot and F. E. Richart, "The Strength of Concrete," *Bulletin No. 137*, Vol. 18, pp. 16, 19, University of Illinois (1923).

[6] Joseph A. Kitts, "The Absolute Basis of Proportioning," *Proceedings*, Am. Concrete Inst., Vol. 25, p. 741 (1929).

[7] Standard Method of Test for Apparent Specific Gravity and Absorption of Coarse Aggregate (C 127 – 39), 1939 Book of A.S.T.M. Standards, Part II, p. 300.

[8] Standard Definitions of Terms Relating to Specific Gravity (E 12 – 27), 1939 Book of A.S.T.M. Standards, Parts II and III.

[9] Standard Method of Test for Apparent Specific Gravity of Coarse Aggregates (D 30 – 18), 1933 Book of A.S.T.M. Standards, Part II, p. 994.

[10] Tentative Method of Test for Apparent Specific Gravity of Coarse Aggregates in a Saturated Condition (C 86 – 31 T), 1935 Book of A.S.T.M. Tentative Standards, p. 612; *Proceedings*, Am. Soc. Testing Mats., Vol. 31, Part I, p. 766 (1931).

[11] Standard Methods of Test for Absorption and Apparent Specific Gravity of Natural Building Stone (C 97 – 36), 1939 Book of A.S.T.M. Standards, Part II, p. 133.

for specific gravity on this volume basis. In fact, in the 1939 Book of A.S.T.M. Standards, Part II, page 301, we may see "Bulk sp. gr. $= \dfrac{A}{B-C}$," while on page 134 of the same publication we may see "Apparent specific gravity $= \dfrac{A}{B-C}$." In each case, *A*, *B*, and *C* represent the same measurements.

Since the Definitions E 12[8] are not concerned with the type of volume requiring the inclusion of voids among the particles, the fact that the term "bulk" is more appropriate for such types of volume is not at first evident when this reference is used. When the full range of volume concepts is considered, it seems evident that there is something wrong with the use of such divergent terms as "Absolute" and "bulk" to describe apparent volume and its specific gravity.

In the left-hand column of Table I, below the definition for apparent volume, are definitions of other concepts of volume to show where such terms as "solid" and "absolute" might better be applied; also to show the type of volume and specific gravity described as "apparent" by Definition E 12;[8] and to complete the range of volume concepts so as to obtain a better perspective for defining apparent volume, the term in which we are primarily interested in connection with concrete. These latter terms have no value in ordinary concrete computations and require no discussion other than to call attention to their positions and descriptions in Table I.

Density

The term "density" was not given a place in Table I because it is not a term commonly used or misused in connection with discussion of granular materials, at least in so far as their discussion in relation to concrete making is concerned. Nevertheless, because the term "density" is so often confused with some of the terms which have been discussed, the following comments are made in an effort toward simplification and clarification of its meaning and use.

Investigation of the definitions of the word "density" as used in the realm of physics reveals no less than three interpretations of what the word may mean. Simply stated, they say (1) it means the same as specific gravity, (2) it means the same as unit weight, grams per cubic centimeter or pounds per cubic foot, or (3) it means the solid portion, 1.00 minus the voids. No wonder the average worker is often uncertain about proper usage of the term "density."

Since we have the term "specific gravity" clearly defined and generally well understood, it would seem that use of the term "density" for this purpose is useless and should forthwith be abandoned. The term "unit weight," or more specifically grams per cubic centimeter or pounds per cubic foot, is concise, direct, and unmistakable; there seems little excuse for using any term that is less specific, particularly a term like "density" which has a more appropriate meaning.

The physical condition most aptly described by density is that portion of over-all space occupied by the solid material; that is, 1.00 minus the voids or 100 per cent minus the percentage of voids. Hence, the more a substance is composed of voids, the lower its density; the less it is composed of voids, the higher the density. Until a better term is adopted to describe this condition, it is suggested this meaning of density be emphasized in future standards and recommendations. This meaning of "density" has been called "solidity ratio" by Gilkey, Murphy, and Bergman in their recent book "Materials Testing." This is an accurate term and with its use, together with the terms "specific gravity" and "unit weight," need for the word "density" in connection with granular materials for concrete is eliminated, and the confusion that has resulted from the word "density" is avoided. The general formula for this meaning of density is:

$$\text{Density} = \frac{\text{Unit weight of the material including certain voids}}{\text{Unit weight of water} \times \text{specific gravity of the material excluding the voids included in the unit weight}}$$

It is interesting to note that the other confusing meanings for density are elements of this formula.

More specific conceptions of density on the suggested basis are indicated in the several conceptions of volume and specific gravity shown in Table I. Unit weight and specific gravity on the appropriate basis would be used in the above general formula. For instance the density of loose bulk (or of consolidated bulk) material would be the weight per cubic foot of the material on this basis divided by the product of 62.4 times the *apparent* specific gravity; the density of material on the apparent volume basis would be its weight per cubic foot divided by the product of 62.4 times the *absolute* specific gravity; the density of the material on the absolute volume basis will, of course, be 1.00 or 100 per cent. These densities would then be known as the loose bulk or consolidated bulk density, the apparent density, and the absolute density; absolute density obviously indicating the absence of all voids.

Proposed Procedure for Securing General Use of Revised Definitions

If the series of definitions could be reviewed and an acceptable terminology agreed upon by properly constituted authorities such as the A.S.T.M. Committee E-8 on Nomenclature and Definitions, uniform usage could be established in a few years by such steps as the following:

1. Revision of A.S.T.M. Methods E 12[8] and C 127.[7]
2. Use of the same terminology in all American Concrete Institute standards, particularly in the "Manual of Concrete Inspection" and in the "Design of Concrete Mixes" when these are finally adopted.
3. With authors' consent, use of the adopted terms in all A.S.T.M. and A.C.I. papers and publications.
4. With publishers' approval and author's consent, use of the adopted terms in subsequent editions and new issues of such widely distributed publications as those of the Portland Cement Association, Bureau of Standards, Bureau of Public Roads, Bureau of Reclamation, Highway Research Board, National Sand and Gravel Association, National Crushed Stone Association, National Slag Association, and perhaps in a number of the engineering publications such as *Engineering News-Record*, *Civil Engineering*, *A.S.C.E. Proceedings*, *Western Construction News*, *Concrete*, *Rock Products*, and *Pit and Quarry*.

Trends in the Technique of Industrial Radiography

By Herman E. Seemann[1]

THE NATIONAL defense program has given tremendous impetus to the application of radiographic methods of inspection and control. The change to a war status will undoubtedly intensify this expansion. The effect has been not only to expedite the development of new apparatus and materials for industrial radiography, but also to make fuller use of previously known refinements in technique. It is the purpose of this paper to review and analyze the principal factors involved in modern methods of radiographing materials.

In general, the two main problems of the radiographic method are to produce the exposure within a reasonable time, and to secure adequate sensitivity in the detection of flaws. The exposure time is governed by the "speed" of the film and of the intensifying screens (if used), and by the intensity and penetrating power of the radiation. Radiographic sensitivity is determined by the contrast and sharpness of the image, and these, in turn, depend upon factors which may, within certain limits, be modified by the operator.

Very often the factors making for shortness of exposure involve a loss in radiographic quality, and careful judgment must be exercised to select the most suitable compromise. In every case the choice of technique must be within the limitations of the equipment available. It is hoped that this review will contribute to a better understanding of the principal features of radiographic procedures, and thereby facilitate the choice of techniques for the various types of examinations.

Intensifying Screens

The established method of shortening radiographic exposure consists in using intensifying screens, with which the fluorescent radiation from the screen reinforces the direct action of the X-rays upon the film. Calcium tungstate screens emit fluorescent light, which may shorten exposures (as compared with direct X-ray exposures) by a factor of 100 or more, depending on kilovoltage and thickness of metal. Lead foil screens intensify the image by the emission of electrons and secondary X-rays, but their intensifying factor is relatively small, being rarely over 3 in practice. (See section on Lead Screens.) Each of these types of screen exerts its characteristic effect upon the quality of the radiograph.

It must be pointed out that the chief practical advantage of tungstate screens is the shortening of exposure time, and that the disadvantage of a certain lack of sharpness in the image naturally accompanies their use. This "unsharpness" is caused principally by the diffusion of screen light across image boundaries within the body of the screen itself. The need for intensifying screens arises when lead screen exposures become too long for practical use. Creditable radiographs are being made every day with intensifying screens, but economy of exposure time is the basis for their selection. Special screens have been developed for use in medical radiography which give better definition than those used for the highest speed medical work. Trials indicate, however, that the regular industrial screens are not only faster but yield just as good definition as special medical screens for steel thicknesses greater than $^1/_2$ in.

Calcium tungstate intensifying screens are not so effective in reducing exposure times for gamma rays as they are for X-rays. They would still be useful, however, if the definition were as good as it is with X-rays. In fact, intensifying screens give results of such poor quality that lead screens are universally used with gamma rays in spite of their relatively low speed.

Care should be taken in using intensifying screens to provide perfect contact between screen and film surfaces. It is obvious that the film is bound to record only a fuzzy outline of the screen image if there is a small space in which light may spread from one part of the image to another. The use of a sturdy, rigid cassette, lined with felt or thin sponge rubber and equipped with spring clips on the back, cannot be too strongly recommended. Makeshift devices may be required for special jobs, but the need for intimate screen contact must be taken into account in every case. Excessive *localized* pressure must be guarded against because of the risk of producing pressure marks on the film. A simple test for contact is to radiograph a coarse wire screen placed on the cassette. Its outline will be sharp where contact is good and diffuse in regions where it is poor.

Flexible screens are of advantage in many practical cases where the film must be bent to conform to a curved surface. Commercially available flexible screens are similar in radiographic properties to the ordinary type.

Intensifying screens should be handled carefully and kept as clean as possible. Actual damage is irreparable but ordinary dirt may be removed with mild soap and water. It is difficult in many industrial plants to provide adequate care for screens but, as a rule, carelessness is the chief detriment to long life. Dirt on the active face of the screen shows lighter than the surroundings in the radiograph and, if allowed to accumulate, causes unnecessary wear and interferes with the rendition of detail. Screens should never be exposed to the direct full intensity of an X-ray beam because this may excite sufficient afterglow (phosphorescence) to be recorded during the *next exposure* and complicate interpretation of the first image. If the cassette extends beyond the boundaries of the specimen, satisfactory reduction of intensity in this region may be obtained with a lead mask or by using a filter near the X-ray tube. Openings through a casting should be plugged. Excessive exposure also tends to discolor screens and thereby to decrease their speed. In ordinary use, screens wear out mechanically before their emission is seriously impaired.

Lead Screens

The intensifying action of lead screens increases with the "hardness" of the radiation at least as high as 220 kv. and

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with increasing metal thickness. The primary rays are therefore intensified more than the longer wave length secondary rays. Thus, the secondary radiation does not produce so great an effect on the film *relative* to the primary as it would if the film were used alone. Furthermore, the front screen *absorbs* the secondary more than it does the primary because of the wave length difference and also because, on the average, the secondary has a longer path through the front screen. Thus, we have two effects, both of which help to diminish the influence of secondary radiation in reducing contrast.

A front screen thickness of 0.005 or 0.006 in. is satisfactory for most work. All of the electrons which succeed in getting out of the foil come from a layer much thinner than this. The thickness suggested seems to be a fair compromise between sufficient absorption of secondary radiation and adequate transmission of primary radiation. A thicker back screen may be used to absorb back scatter.

Lead foil is somewhat awkward to handle, particularly since care must be used to avoid the formation of sharp wrinkles which may show in the radiograph. It is most convenient to use when mounted on a stiff support such as cardboard. This does not affect its radiographic properties. The lead surface should be kept free from particles of dirt since all materials are more or less strong absorbers of electrons and will therefore leave their record in the radiograph. Lead foil for radiographic use should be selected for this purpose, otherwise there is the possibility of obtaining some tin streaks or other surface markings which may show in radiographs.[2]

Lead screens are particularly beneficial in the radiography of small objects. A comparison of radiographs made with and without lead screens will show that the lead reduces the amount of secondary radiation undercutting the specimen around its periphery. The explanation of this is that the *full intensity* of the X-ray beam striking the cassette and film outside the specimen can produce enough scatter to be objectionable when compared with the relatively low intensity which passes *through* the specimen. The introduction of the front lead screen decreases the undercutting of scatter by decreasing the intensity of the primary beam which causes it. The primary radiation transmitted by the specimen is quite hard and is therefore only slightly absorbed by the lead foil.

Whether an actual reduction in exposure time is made possible by the use of lead screens depends on the relative magnitude of the several effects: absorption of primary radiation, absorption of secondary radiation, and intensification of primary and secondary radiation. These effects in turn depend upon the thickness of the specimen and the kilovoltage used. The relations are too complex to be covered by a general statement, but fortunately for practical applications, lead screen technique is simple. It must be kept in mind that reduction in exposure time is not and should not be considered to be the *chief* criterion for choosing between lead screen and direct-exposure techniques. Radiographic quality should be the primary consideration. At low voltages, the use of lead screens may actually require a longer exposure time, but if the quality is better than that in the direct exposure, their use is recommended. Conversely, the front screen should not be used when the voltage is so low that its absorption results in too low a subject contrast. (Film *definition* is just as good with lead screens as without.)

A test showed that in radiographing 4 or 5 in. of aluminum at 160 kv., films made with and without lead screens were of practically the same density, all exposing conditions being the same. With the aluminum placed near the X-ray tube, so as practically to eliminate secondary radiation, the lead screen film showed considerably greater density. This illustrates the fact that intensification (adding density) *may* just compensate for the removal of secondary radiation (reducing density). A similar type of result was obtained with $^3/_{16}$-in. steel exposed at 140 kv. There may be many other combinations in which intensification is just balanced by the reduction of secondary radiation.

Much of the advantage of the lead screen technique is lost unless good contact is maintained with the film. The effect is somewhat similar to that obtained when tungstate screens are used, namely, a space between screen and film permits spreading of the emission across image boundaries. At low voltage, the intensification of the primary rays may be so slight as to be negligible, and intimate contact will therefore be of no importance. It is a better rule, however, to be on the safe side, to provide good contact at all times.

The Focal Spot

Other factors being the same, the size of the focal spot of the X-ray tube (or of the radium salt in gamma-ray exposures) has a direct bearing on the sharpness of the shadow image formed. The smaller the focal spot, the better defined the image will be. The limitation to indefinitely small size is based on the necessity for dissipating the heat generated at the focal spot. Reduction of the power supplied to the X-ray tube would, of course, make it possible to use a very small focal spot but, because of the economic need for obtaining a radiograph with a reasonably short exposure, a compromise must be reached between the time of exposure and the radiographic quality.

Given the practical situation where the best possible definition is desired with a given tube, the selection of focus-film distance has an important bearing on image sharpness. Simple analysis shows that the geometrical "unsharpness" $u = ft/(d - t)$, where f is the diameter of the focal spot, t is the distance of the point of interest from the film, and d is the focus-film distance. For practical pur-

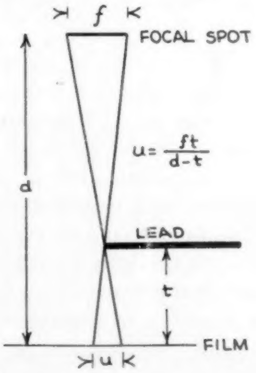


Fig. 1.—Geometrical Unsharpness Is Caused by the Finite Size of the Focal Spot. From similar triangles, $u/f = t/(d - t)$ therefore, $u = ft/(d - t)$.

[2] Ready-mounted lead foil for screens is commercially available from the General Electric X-ray Corp., Chicago, Ill.

poses, t may be taken as the thickness of the specimen because this is the maximum distance from the film where a void or flaw can exist. The space between specimen and film is assumed to be negligible. In this formula, u is the width of the fuzzy projected outline of the edge of a lead plate at distance t from the film (see Fig. 1).

Substitution of some reasonable values will illustrate the use of this formula. Assume a focal spot diameter of $^2/_8$ in., $t = 1$ in. and $d = 20$ in. The resultant unsharpness is 0.020 in. Thus, from *geometrical considerations alone* the fuzzy boundary of the image will be 0.020 in. wide. It *may* be worse because of the influence of other factors. Suppose we now change the focus-film distance to 40 in. The unsharpness will decrease to 0.0096 in., or about half as much as before. Continued increase in d will, of course, result in progressively smaller values of u, but a point will finally be reached where the eye cannot see any difference in the radiograph with increase in distance. Exposures will also become too long for economical operation. If $^1/_2$-in. material is to be radiographed, instead of 1-in. as assumed above, the unsharpness will be about one-half as great. It will continue to decrease with decreasing thickness but changes will not be noticed by the eye beyond a certain point. Just where these changes become negligible will depend upon the type of film and screens used as well as upon the sharpness of boundary of the detail being studied. Differences in geometrical unsharpness will not be so noticeable, in general, with intensifying-screen exposures as with lead screen exposures, assuming the contrast to be the same in both cases, because so much unsharpness is caused by the intensifying screens themselves.

The image of a spherical gas bubble in a casting can never be so sharp as the image of a hole of equal depth drilled in the direction of the rays because the *change in metal thickness* is much more abrupt in the latter. Thus, changes in focal-spot size or in focus-film distance will be more noticeable in the image of the drilled hole since it forms a more critical test object. The image of the bubble is inherently diffuse in appearance and therefore cannot be improved so much by adjustment of geometrical factors.

In most cases, the thickness is small compared with the focus-film distance. The unsharpness formula may then be written $u = ft/d$, approximately. From this we find that, using the same focal-spot diameter, the geometrical unsharpness will be unchanged if the distance is adjusted so as to be *directly proportional* to the thickness of the specimen. Similarly, if several focal-spot diameters are available, the same geometrical unsharpness will be obtained with all if they are chosen to be *inversely proportional* to the material thickness, the focus-film distance being constant.

Variable Illumination

In the radiography of welded vessels or other structures in which the metal is practically uniform in thickness, it is common practice to use as low a kilovoltage as possible. This gives the maximum subject contrast and is most effective for the best rendition of detail. Under these conditions, the exposure may be adjusted so that the density in the resultant radiograph is suited to the brightness of the average illuminator. On the other hand, an irregular casting may have such high subject contrast that its radiograph shows a range of photographic densities which cannot be viewed properly at any one level of illumination. A high photographic density may contain as much detail as a low density, but the details are not seen merely because the illuminator does not supply enough light to suit the human eye.

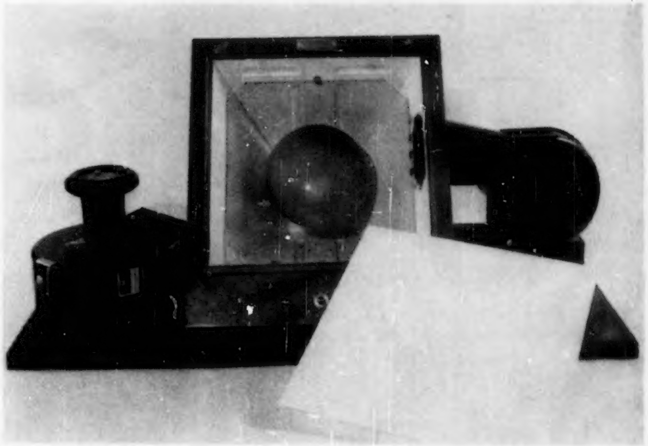


Fig. 2.—Kodachrome Illuminator Adapted for Viewing High-Density Radiographs. Flashed opal glass removed to show construction.

An adjustable illuminator capable of giving a high maximum brightness is a valuable accessory in any radiographic laboratory. Such a device is easily built, using an ordinary 8 by 10-in. X-ray illuminator or a 10 by 10-in. Kodachrome illuminator, as the basic unit. Fitted with a No. 1 Mazda Photoflood lamp, and connected with a small autotransformer, or a 100-ohm rheostat of 2.4 to 1.2-amp. capacity in series with the lamp, it makes an excellent variable high-intensity light source. The life of a No. 1 Photoflood lamp, when operated on full voltage, is about 2 hr., but, in this application, maximum intensity is likely to be needed only infrequently, and more than the rated life of the lamp may be expected.

Even more intensity can be obtained by using an R2 Photoflood lamp in the Kodachrome illuminator (see Fig. 2). Considerable heat is generated so that forced cooling is necessary. A plate of Corning Aklo heat-absorbing glass is fastened inside the illuminator just in front of the lamp. A small blower sends air into the side of the illuminator between the front opal glass and the Aklo glass. Cutting off corners of the Aklo glass permits the air to enter the lamp compartment, thus keeping the glass and lamp temperatures within reasonable limits. The air finally leaves the illuminator through slits already provided. Even though considerable heat is absorbed in the glass, a dense film will overheat if viewed too long, simply because of its own absorption of visible and invisible radiation. However, the front glass of the illuminator does not become hot so that contact with it will not injure the radiograph. The 40-ohm rheostat used with the R2 Photoflood lamp should have a capacity of about 4.6 to 1.8 amp. A plate of Aklo glass $^1/_8$ in. thick and $8^1/_2$ in. square (but with the corners cut off) will fit the illuminator at the right location. A clear glass may be used instead of the flashed opal front if still greater intensity is desired over a small area.

Some idea of the brightness of the flashed opal glass front of the special illuminators described may be obtained from

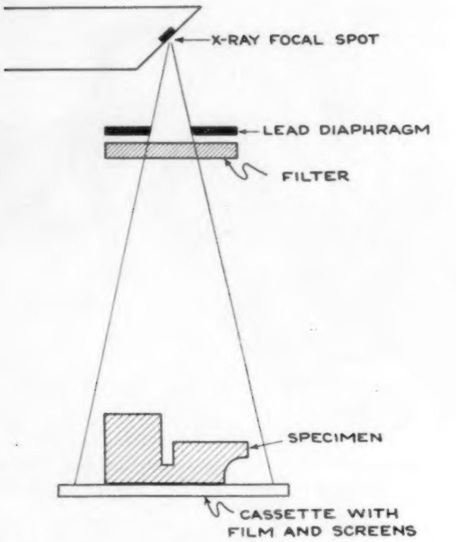


Fig. 3.—A Filter Placed Near the X-ray Tube Reduces Subject Contrast and Eliminates Much of the Secondary Radiation Which Tends to Obscure Detail in the Periphery of the Specimen.

the following: Let the brightness of a commercial 14 by 17-in. X-ray illuminator containing two fluorescent tubes be taken as unity. On this basis, the Kodachrome illuminator with a No. 1 Photoflood lamp will emit a maximum of about 15 units per unit area, and the illuminator shown in Fig. 2 will give about 45 units per unit area. If the flashed opal glass is removed, the brightness of the central area of the R2 Photoflood lamp is found to be over 500 units. These figures are all for maximum brightness and, of course, are approximations since line voltage, age of lamps, and variations in flashed opal glass have decided effects on brightness. If a radiograph with a photographic density of 1.0 is viewed comfortably on a 14 by 17-in. illuminator of the type first mentioned, a small area with a density of 3.7 will appear equally bright when viewed over the center of a bare R2 Photoflood lamp. Thus, an extreme range of viewing conditions is provided with simple equipment.

In employing extra-bright illumination, fairly transparent areas, corresponding to the thickest parts of the subject, materially handicap the eyes in seeing detail in the darker portions. It will be found advantageous, therefore, to mask off such areas so that the eyes are not subjected to glare. A cardboard mask of a size to cover the window of the illuminator, and having a circular hole in the center, is helpful in restricting the area of intense illumination. It is advisable to have a selection of several masks with different size openings.

It is worth keeping in mind that the eyes require a few minutes to accommodate themselves to any marked change in light intensity. Therefore, in order not to subject them to unnecessary extremes during the interpreting of radiographs, subdued general illumination should be provided in the viewing room itself. Subdued lighting is definitely preferable to bright lighting, or to no lighting at all, since it approaches more closely the degree of illumination transmitted through radiographs on the viewing equipment.

Filtration

Special illumination is not always an adequate provision for viewing the radiograph of high contrast. If the contrast is too high, some change must be made in the exposing technique. Of course, separate exposures may be made for the different thicknesses of the specimen and this is excellent from the technical standpoint, but it may be too laborious. The same may be said for masking with sheet lead or barium clay, or filling in the thinner regions with a uniform absorber, such as fine copper shot.

Subject contrast may be reduced by placing a suitable filter in the X-ray beam as near the tube as possible (see Fig. 3). Longer exposure, or increased kilovoltage, will be needed to make up for the extra thickness of metal to be penetrated. This is not a serious handicap unless the machine is already being operated at its maximum capacity. The filtration technique has been investigated up to 220 kv. but there is no reason to suppose that this represents its limit of usefulness.

In order to clarify the function of a filter, let us assume that a certain specimen to be radiographed is composed of two principal thicknesses of steel, $^1/_8$ in. and $^7/_8$ in. When a satisfactory exposure is made for the $^7/_8$-in. part, the radiographic density is too high in the $^1/_8$-in. part. If $^1/_2$ in. of steel is introduced as a filter and the kilovoltage suitably increased, both thicknesses may be well rendered in the same radiograph. A certain loss of radiographic sensitivity is to be expected because of the additional metal to be penetrated but the loss is not so great as if the filter were a part of the specimen because, being near the tube, very little of its secondary radiation can reach the film.

There are other advantages in having the filter near the tube. Only a small piece, which is convenient to handle, need be used. Small scratches or dents in the filter are not likely to show in the radiograph because of their "out-of-focus" position. Since the intensity of the *entire* X-ray beam is reduced by the filter, there is less chance for that which misses the specimen to excite appreciable back scatter. In fact, the full intensity of the radiation from the tube should not be permitted to strike material behind the cassette (see Fig. 4).

Metals like copper or lead make good filters because, for the same absorption, they are less bulky than aluminum or steel. The thickness of filter chosen will depend, of

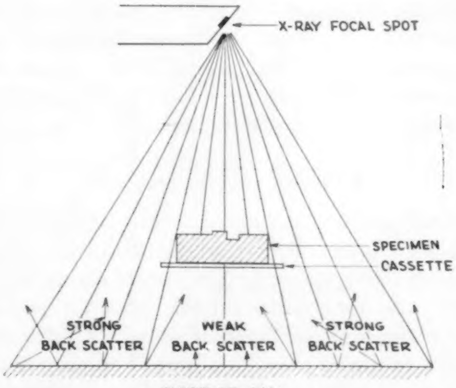


Fig. 4.—Schematic Diagram Showing Where Intense Back-Scattered Radiation May Originate. Coning, masking, or diaphragming should be employed here. Backing the cassette with lead may give the film adequate protection.

course, upon the total thickness and the thickness variation in the specimen. The situation is therefore too complex for formulating an exact rule, but a rough generalization is that, for the radiography of aluminum, the copper filter thickness should be about 0.04 of the maximum specimen thickness. The ratio for copper filter and steel specimen is 0.2, and for a lead filter with steel, 0.03. Since the filter thickness is not critical, satisfactory results may be obtained by classifying specimens so that a certain range of thicknesses may all be radiographed using the same filter.

It was pointed out in the section on lead screens that they act as filters in addition to their other functions. At low voltage, say around 100 kv., they may act *primarily* as filters and to use additional filtration near the tube would almost certainly be too much. If, on the other hand, it were found better to omit the front lead screen, some radiographic improvement might be noted by using a filter having less absorption than this screen. The operator should keep a log book of techniques used in special cases since the accumulated information will be of help in estimating factors in future work. Such a record makes a valuable supplement to the usual exposure chart.

X-Ray and Gamma-Ray Films

Recent progress in the radiographic inspection of industrial materials has been in two principal directions: First, the development of equipment which is convenient to use and which covers a wide range of radiation qualities, and second, the evolution of films to suit the various radiations and the more exacting requirements of modern radiography. By choosing the proper machine, radiographs may be made in the range from 5 kv. to 1000 kv. Radium, as commonly supplied in its little "pill," furnishes us with an even shorter wave length source.

There are two principal factors that determine the visibility of detail in a radiograph, *contrast* and *definition*. If two different metal thicknesses yield a large density difference in the radiograph, the contrast is said to be high; if the density difference is small, the contrast is low. Obviously, the technique which produces high contrast will give better clarity of detail than one which does not. The contrast characteristics of the film, time and temperature of development, kilovoltage, thickness of specimen, and amount of secondary radiation are all factors which affect the contrast of the radiograph.

If the boundary between two areas of different densities is sharply defined, it will be more conspicuous than if that boundary shows a gradual change in density. The situation is similar to the improvement in detail in a photograph taken with the camera in focus as compared to one which is out of focus. It has been pointed out in the section on "The Focal Spot" that geometrical unsharpness affects the rendition of detail. The choice of film and screens is also very important.

It is apparent that to enable fine structures to stand out best, high contrast and a minimum unsharpness are both required. Little can be said about the net result of high contrast combined with a large unsharpness value or of low contrast combined with a small value of unsharpness, since the value of high contrast may be partially or totally lost if accompanied by diffuse boundaries in the image. Similarly, if the unsharpness is small, details may be

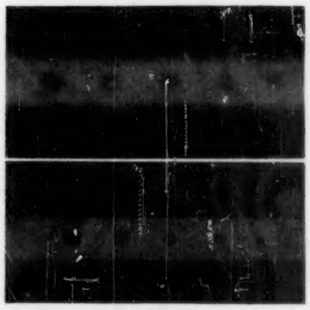


Fig. 5.—The Value of the Higher Contrast in *A* Is Largely Offset by Poor Definition. In spite of the lower contrast in *B*, better rendition of detail is obtained by the improved definition.

distinct in spite of low contrast, though, of course, they would be *more* distinct with higher contrast, see Fig. 5. In the radiography of an irregular casting with a single exposure, wide latitude is necessary for rendition of all parts. This is likely to require some sacrifice in contrast but the loss of detail may be partially or completely rectified by an improvement in definition. These principles need to be kept in mind when judging radiographs made with different techniques. The choice of the best film for a certain job will not necessarily make up for indifference toward other variables.

Upon close examination, X-ray and gamma-ray radiographs made with direct radiation (or with lead screens) show a certain amount of graininess. This is usually more conspicuous in the faster films. For the same contrast, the less grainy films show greater detail. Thus, graininess may be classed as one of the factors in definition and should be so considered when planning a technique. A slow film speed, and generally a high contrast, are associated with fine grain. *If the exposure time were of no consequence*, such a film would almost completely displace all others. A contrasty, fine-grain film may be used with a higher kilovoltage than films of lesser contrast, to secure the same resultant contrast in the radiograph, and with the improved definition provided by such a film, an even lower radiographic contrast, produced by a further increase in kilovoltage, is permissible. The greater X-ray output arising from the higher kilovoltage helps to offset the slower speed of the film.

A given film shows increasing graininess with increasing hardness of radiation. This effect is not noticeable for small changes in kilovoltage, such as minor adjustments to change the penetration where the approximately correct kilovoltage is established. A similar effect is found with tungstate intensifying screens but, in this case, the film is simply recording the characteristics of the screen whose light is almost exclusively responsible for the exposure. Screen graininess is usually coarser and more diffuse in appearance than film graininess. In general, a fine-grain, high-contrast film (direct-exposure type) is to be preferred for exacting work and the coarse-grain film, or one for use with intensifying screens, left for the cases where thick materials are to be examined, requiring the fastest radiographic recording medium.

By way of illustration, consider the choice of materials for the radiography of 2-in. steel plate. If the maximum kilovoltage available is 220 kv., screen-type film will be used with tungstate screens. The actual kilovoltage used,

however, will be adjusted to the lowest value consistent with a reasonable time of exposure. A direct-exposure type film with lead screens would be used at 300 kv. The slower, fine-grain type is preferable from the standpoint of quality and continues to be all the way up through the 1000-kv. region to gamma-rays. This type is recommended for gamma-ray work when overnight exposures can be made, but if only 2 or 3 hr. can be spared, the faster type must be used.

The great bulk of magnesium and aluminum work is done at such low kilovoltages that the limit of the machine is seldom reached if a slightly higher kilovoltage is used to offset the slow speed of a fine-grain film. Screen-type film, when exposed to direct X-rays (with or without lead screens), usually has a low contrast and intermediate graininess and speed. Its application in this manner is quite limited, being supplanted by the higher contrast films.

The simultaneous exposure of two films, superimposed in the cassette, permits a shortening of exposure time and has the additional advantage of *increasing contrast* when the two radiographs are viewed superposed. If lead screens are used, a third sheet of lead unmounted would be sandwiched between the two films. This procedure is equivalent to *increasing the latitude* of the film, since high densities corresponding to thinner metal may be viewed in the single films and low densities representing thick sections may be viewed with the films superposed.

Microradiography

Microradiography differs from ordinary radiography primarily in the fact that it is customary to enlarge the radiographs in order to study the fine structure of the specimen. For enlargements of 50 or 100 diameters, special fine-grain emulsions are essential. These have a much lower X-ray speed than the emulsions commonly used in the radiography of materials. Successful commercial applications of the microradiographic procedure have been in such unrelated fields as studying the cemented joint in corrugated cardboard and distinguishing between natural and cultured pearls. Of particular interest to the metallurgist is the fact that enlargements of low voltage radiographs of thin specimens of an alloy are capable of disclosing the difference in absorption of segregated constituents.

The general procedure is to prepare a specimen of the metal by grinding it down to a few thousandths of an inch in thickness. It is then mounted close to or in contact with a special fine-grain photographic plate and radiographed. The X-ray tube voltage chosen is likely to be in the range from 5000 to 20,000 v. Trials will be necessary to find out just what radiation quality is best suited to a given kind of material. It may be desirable to select a particular target material for the X-ray tube in order to match the radiation with the absorption characteristics of the alloy to best advantage. Whether the continuous spectrum from one target at a certain voltage is better than the line emission spectrum from another is a point on which complete agreement is lacking. Certain it is, however, that attention must be paid to the choice of radiation quality for best results to be obtained. After processing, the radiograph is enlarged by ordinary optical projection or viewed through a low-power microscope.

American Cotton Handbook

This new publication prepared by three prominent educators in this field, G. R. Merrill of Lowell Textile Institute, A. R. Macormac of Alabama Polytechnic Institute, and H. R. Mauersberger of Columbia University, covers 1024 pages, with a great wealth of material on the historic, economic, social, technical as well as chemical phases of the cotton growing, manufacturing, and processing industry in America. Many members of the Society will be interested in the publication.

Cooperating with the three editors, each of whom reviewed the whole book, were other textile technologists. The section on Physical and Chemical Testing of Fibers, Yarns, and Fabrics covers some 70 pages and, of course, includes a large number of references and information from A.S.T.M. standards which have been developed through the work of Committee D-13. Professor E. R. Schwarz of M.I.T. prepared the material on physical testing and also with his associate, K. R. Fox, discusses the use of the statistical method in testing.

Other chapters in the publication cover problems of the cotton growing and manufacturing business, and various classes of products. There is a section devoted to English cotton literature and of considerable interest is a cotton glossary covering some 45 pages.

This book ($5^1/_4$ by $7^3/_4$ in.) can be obtained from the American Cotton Handbook Co., 303 Fifth Ave., New York, N. Y., at $4.80 in the United States and Canada and $6 in other countries.

"Mechanical Properties of Materials and Design"

This is the title of a book prepared by Prof. Joseph Marin of Pennsylvania State College, the object of the book being "to furnish a survey of the mechanical properties of engineering materials and to show how a consideration of these properties modifies usual design procedure."

Simple and combined stresses—static, fatigue, impact, and creep—are considered with respect to the properties of materials when subjected to such stresses, interpretation of test results, and theories and calculations, involved in design of machine and structural members in accordance with the stresses to which they will be subjected. A number of examples and problems are given at the end of each chapter.

An active A.S.T.M. member, Professor Marin has included references to pertinent A.S.T.M. specifications and methods of test and to a number of papers and reports appearing in Society publications which contain material tying in with the subjects under consideration.

Copies of this 280-page book, containing 142 figures, can be procured from the McGraw-Hill Book Co., Inc., 330 W. Forty-second St., New York, N. Y., at $3.50 per copy.

A Study of Secondary Radiation in Relation to the Radiography of Aircraft Castings[1]

By L. W. Ball[2]

In the radiography of aircraft castings it is not sufficient to think in terms of generalities. Precision in the control of each factor of the X-ray procedure can be attained even under mass-production conditions. The key to precision is the full utilization of the "Technique Film" method. The principle of this method has been described elsewhere[3] and it is only necessary to repeat here that when a new casting pattern is designed it must be treated as a new individual X-ray problem. A thorough technique must be worked out from the calibration charts and a study of the geometry and stress functions of the casting. This technique is applied to the pilot casting and when approved by the competent authority the technique film and a corresponding technique form are filed so that all subsequent radiography of the pattern is a straightforward, automatic routine.

It is the purpose of this paper to show that all the effects of secondary radiation can be taken into account when preparing technique films, and that inspection failures due to secondary radiations can be avoided.

The range of kilovoltage suitable for the examination of aircraft castings is 30 to 120. In this range there is no practical objection to neglecting the difference in quality between the incident and the scattered radiation, and it is not desirable even to consider the different atomic mechanisms by which scatter is produced.

However, the different sources of secondary radiations and the different paths by which each reaches the films must be studied separately. The experiments described here were arranged on this basis to cover existing radiographic inspection conditions. All the results refer to one X-ray apparatus operated at 70 kv. p., but the experimental procedure and the methods of applying the results are applicable to any X-ray apparatus.

In preliminary experiments a pinhole 0.2 mm. in diameter in 0.012 in. of lead was used to show that the projected focal spot size along the central axis of the X-ray beam was 1.2 by 1.2 mm. Also the direct unfiltered X-ray beam, that is, the total radiation from the tube head, was found to produce a density of 1.0 on Noscreen film in a paper envelope with a back lead screen in 0.00202 ma. sec. per f.f.d.^{2}, where f.f.d. = focus film distance in inches. This was called the intensity of the primary beam. Scatter intensities were expressed as percentages of the primary intensity.

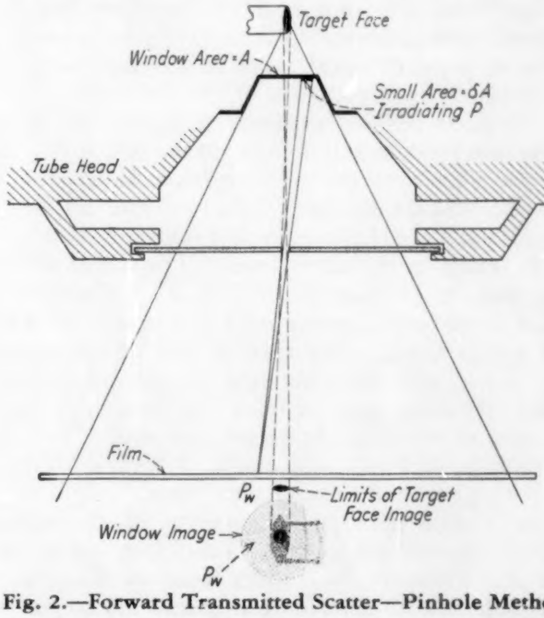


Fig. 2.—Forward Transmitted Scatter—Pinhole Method.

The blackening curve for Noscreen film developed in Kodalk was reestablished both for filtered and unfiltered 70 kv. p. radiation. The exposures were concentrated around film density $D = 1.0$ and the results were plotted as film density against exposure in ma. sec. per f.f.d.^{2} (Fig. 1). The linear character of this curve simplifies subsequent calculations.

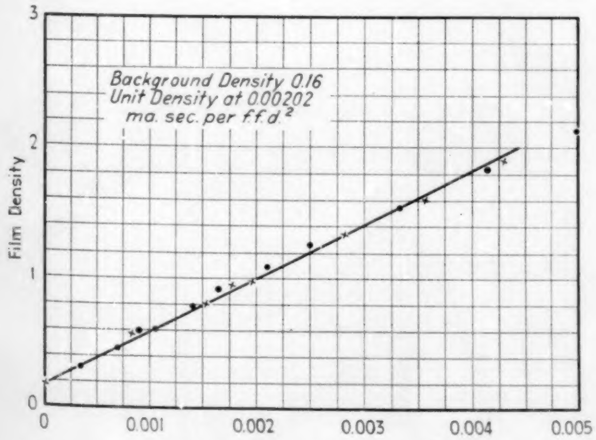


Fig. 1.—Blackening Curve—Noscreen Film, 70 kv.p.

Pinhole Studies of Forward Transmitted Scatter[4] from the Tube Window, Electrodes, Insulating Oil, and Tube Filters

Figure 2 is a drawing of the experimental arrangement for measuring scatter from the window. The size of the

NOTE.—DISCUSSION OF THIS PAPER IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] The substance of this article was presented to Committee E-7 on Radiography as part of an address entitled "Two Recent Advances in the Technique of Industrial Radiography" at the June, 1941, meeting.

[2] Physicist, Division of Physics and Electrical Engineering, National Research Laboratories, Ottawa, Ont., Canada.

[3] Topical Discussion on Radiographic Inspection of Airplane Components, held at 1940 Annual Meeting, Am. Soc. Testing Mats. (Discussion issued as separate publication.)

Also "Radiographic Inspection Procedure for Light Alloy Castings Used in the National Research Laboratories, Ottawa, Ont., Canada."

[4] The terminology used here is part of a proposed recommended terminology now under consideration by Committee E-7.

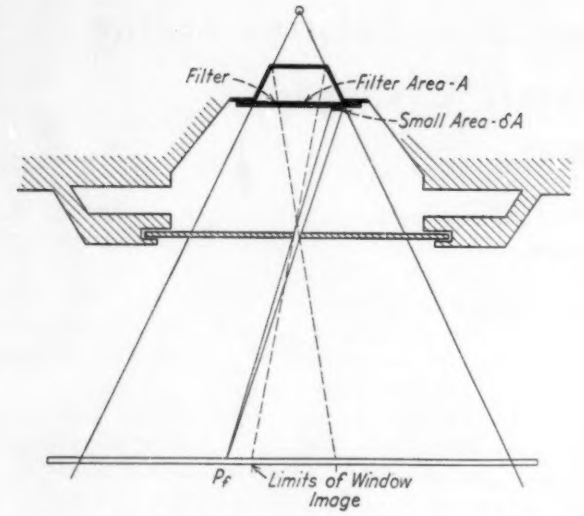


Fig. 3.—Forward Transmitted Scatter from Filters.

pinhole has to be carefully chosen so that it is small enough to separate the images of the focal spot and the electrodes from the image of the window but large enough to allow sufficient scattered radiation to reach the observation point P_W. The exposure was adjusted to produce a film density of 1.0 at P_W.

For the direct beam an exposure of 0.00202 ma. sec. per f.f.d.[2] would produce unit density on the film at P_W. The scatter from the area δA of the window required an exposure of 0.0184 ma. sec. per f.f.d[2] to produce unit density on the film at P_W. Hence δA was a source of X-rays 0.11 times as strong as the direct beam. The whole window had an area, A, 41 times larger than δA. Therefore the whole window could be regarded as a source of X-rays whose power was 4.5 per cent of that of the primary beam. Scatter from the insulating oil was included with that from the bakelite of the window. By similar reasoning it was shown that the target face outside the focal spot could be regarded as a source of X-rays having an output of 3.3 per cent of the primary beam.

Figure 3 illustrates the adaptation of the pinhole method to measure scatter from "tube filters" or window scatter after filtration. It is again necessary to choose the size of pinhole with care and to use lead foil so that the path of the scattered rays is not unduly obstructed. As before, the observed exposure necessary to produce unit film density at a point P_F due to scatter from the filter material may be converted to give the amount of radiation scattered by the whole area of the filter as a fraction of the direct intensity. Two other factors must be considered before the results obtained are applicable to practice.

With the filter in place the intensity of the primary beam is considerably reduced to a new value for each filter. The scatter intensity (I_S) from the filter should then be expressed as a percentage of the new transmitted intensity (I_T) of the primary beam. In the experiment the filter must be placed near the tube so that the inverse square law can be applied as before. This restriction does not limit the application of the results to filters farther from the tube, but of course in the experiment the whole cone of primary radiation excites scatter from the filter, and if in practice a stop is used between the tube and filter,

TABLE I.—USEFUL THICKNESSES OF VARIOUS MATERIALS.

Purpose	Filter 10% Transmission			Shelf, Cassette Cover, etc.		
Material........	0.003 in. lead	0.012 in. copper	0.26 in. duralumin	0.130 in. bakelite	0.14 in. pressed wood	0.12 in. aluminum
100 I_S/I_T........	1.9	1.4	4.0	0.80	0.76	2.0

allowance must be made for the corresponding reduction in the effective area of the filter.

The materials chosen for study are of practical importance as filters, cassette covers, shelves, casting supports, and dust barriers. An example of the latter is in the radiography of live shells or fuses, where it is necessary for the X-rays to pass through the dust-proof window which separates the X-ray apparatus from the explosives. Forward transmitted scatter from this window undercuts the images; so the material must be chosen to produce minimum scatter.

Table I summarizes some results for useful thicknesses of various materials.

Forward Transmitted Scatter from the Casting, Supports, and Cassette Cover

Figure 4 shows the experimental arrangement for measuring scatter from material in contact or nearly in contact with the film. Sheets of 4 per cent copper duraluminum, 1/4 in. thick were used to build up various specimen thicknesses. A lead mask with holes of the diameters illustrated was placed on top of the specimen and a stop was used to limit the main beam to just within the mask.

The film blackening, as measured by a good photometer, at the center of each circular image depends on the diameter of the circular hole. In each case the intensity of the direct radiation (I_D) is the same, but the intensity due to scatter (I_S) increases with the diameter of the hole because the volume of scattering material increases.

All the exposures were arranged to give densities in the range 0.5 to 2.0 and the blackening curve of Fig. 1 was

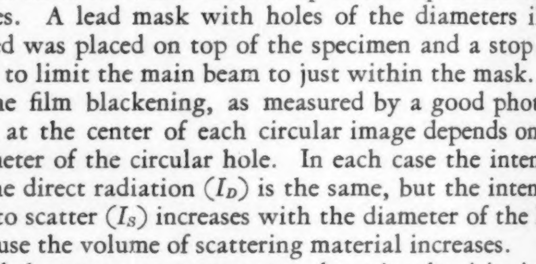


Fig. 4.—Forward Transmitted Scatter from Castings.

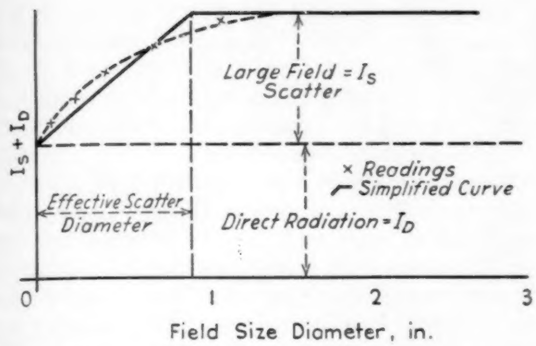


Fig. 5.—Forward Transmitted Scatter—Field Size Method.

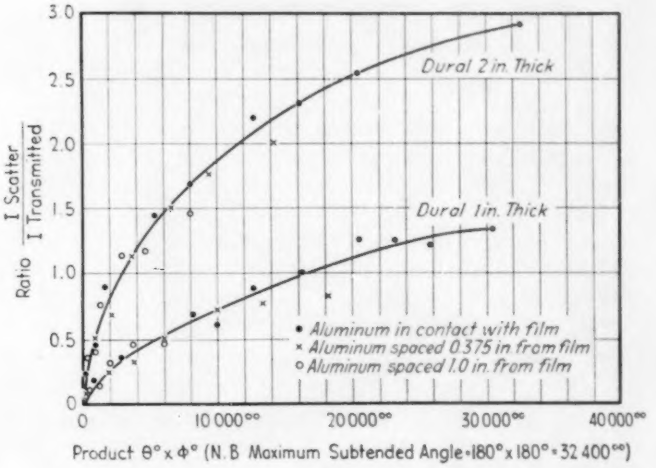


Fig. 7.

used to convert the measured densities into relative X-ray intensities. Then the results were plotted as in Fig. 5 to show the relation between the diameter of the hole (field size) and total X-ray intensity ($I_S + I_D$).

One extra exposure was made with each thickness of specimen with the lead mask omitted. Photometry of this film served to check the uniformity of the X-ray beam and the film emulsion and also provided an intensity ($I_S + I_D$) for an area of about 10 in. in diameter. As can be seen from Fig. 5, this 10-in. diameter was useful as a check on the horizontal (large field) part of the curve.

To apply these results to practice the several curves of the same type as Fig. 5 were analyzed and the information reexpressed by the one graph in Fig. 6.

Each curve of the same type as Fig. 5 was extrapolated slightly to zero field size. Since the scatter intensity I_S must vanish when the amount of scattering material approaches zero, the intersection of the curve with the intensity axis represents the intensity of the direct beam (I_D). Simplifying the actual curve by the substitution of two straight lines was found to be practicable and it has the virtue of providing a satisfactory measurement of the size of what is called "a large field." With the specimen in contact with the film, scatter can reach the center of each circle only by passing through the material of which the specimen is made. Obviously there is a limit to the distance from which scatter is received effectively through the metal and this limit is called the scatter radius. The corresponding scatter diameter is the field size above which no effective increase in scatter is caused by increased field size. Any field size greater than this limit is called a large field.

When I_D has been measured it is a simple matter to subtract I_D from $I_S + I_D$ and thereby obtain I_S and the ratio I_S/I_D. In practice it is this ratio which is usable, hence in Fig. 6, I_S/I_D is plotted as a function of field size and of specimen thickness.

If the specimen is not in contact with the film the scatter intensity is decreased. It is then necessary either to make another diagram like Fig. 6 for each specimen film distance or to find some new way of expressing the amount of scatter.

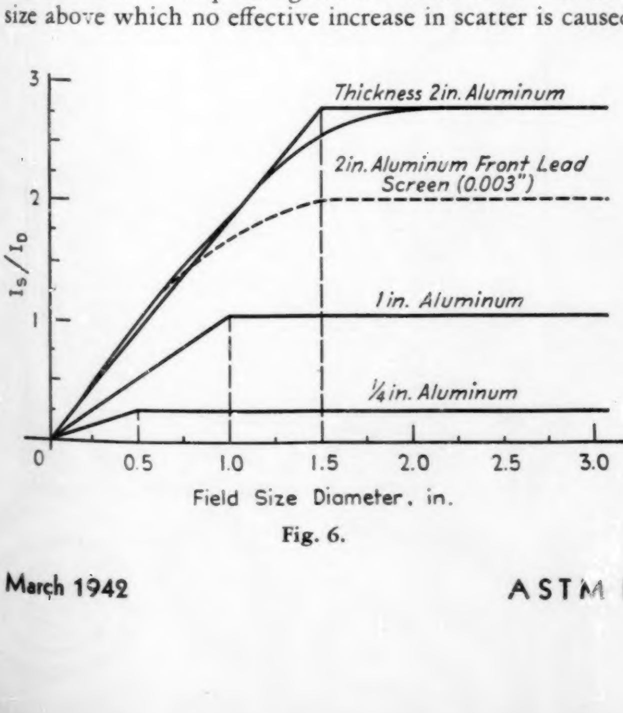


Fig. 6.

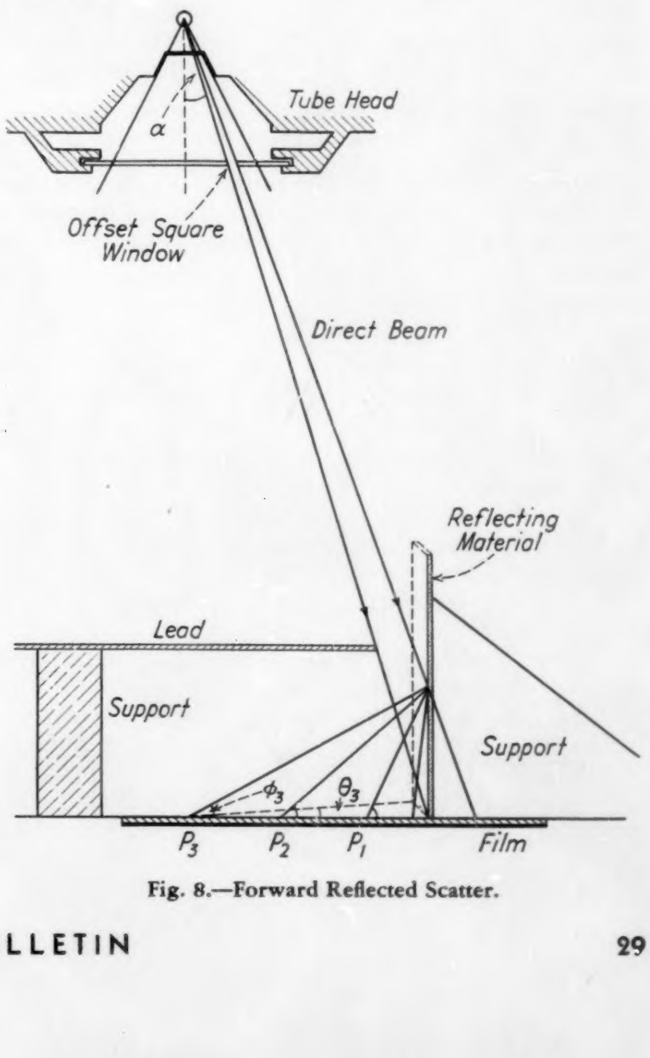


Fig. 8.—Forward Reflected Scatter.

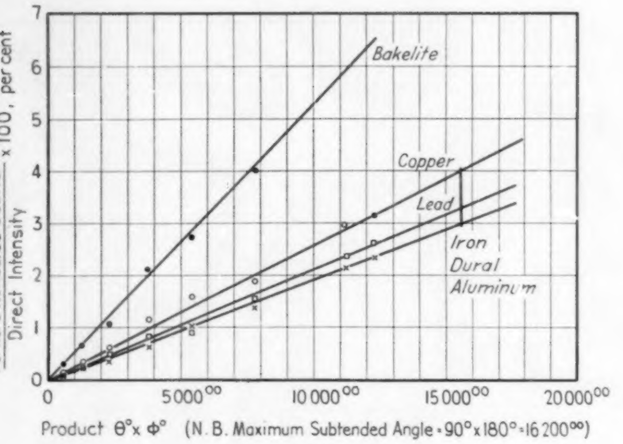


Fig. 9.

This problem was solved by relating I_S/I_D to the solid angle subtended at the film by the scattering volume.

The scattering volume can be considered as replaced by a thin disk of the same cross-section placed one quarter the way from the lower surface of the specimen and parallel to the film. Further simplification is satisfactorily achieved by replacing the rather complicated calculation of solid angles with a simple product $\theta°\varphi°$. In the case of a rectangle θ and φ are the angles subtended at the point on the film by the length and breadth of the rectangle, while in the case of a circle $\theta\varphi$ becomes θ^2, where θ is the angle subtended by a diameter.

Experiments were carried out with film-specimen distances of $^3/_8$ in. and 1 in. and the results are assembled in Fig. 7. A lattice spacer was used to prevent scatter from one hole reaching the images of the neighboring holes.

Forward Reflected Scatter from the Casting and Supports

Figure 8 illustrates the experimental arrangement for measuring forward reflected scatter. The scattering material was supported in a vertical position and the stops were carefully adjusted by fluoroscopy to give the conditions illustrated. The films obtained by this method have a graded blackening along the axis, P_1, P_2, P_3 which is normal to the base of the specimen. The exposures were adjusted so that this gradation was in the range D = 0 to D = 2.0, and the blackening curve of Fig. 1 was again used to transform film blackening into X-ray intensities.

These scatter intensities are produced by scatter of the primary beam of intensity $I_O \sin \alpha$ by a vertical rectangular surface of known dimension (3 in. high by 3 in. long). Again it was necessary to find some way of expressing the amount of forward reflected scatter in a manner applicable to the radiography of castings. At any point on the film such as P_3 the scattering rectangle subtends a vertical angle (φ_3) and a horizontal angle (θ_3). It was proved satisfactory to express the scatter intensity at each point on the film in terms of the product $\varphi\ \theta$ and the primary intensity $I_O \sin \alpha$.

Results of this type are shown in Fig. 9. Fortunately these graphs are straight lines and therefore a forward reflected scatter coefficient can be applied to each material. This coefficient is simply the slope of the curve and the scatter intensity at any point due to the rectangular surface = $I_O \sin \alpha \times \theta\varphi \times$ the forward reflected scatter coefficient.

Back Scatter from Intensifying Screens, Cassette Base, Shelves, and Cabinet Floor

Figure 10 illustrates the experimental arrangement used to measure back-scattered radiation. The primary beam was limited by a lead stop so that a rectangular area of the back scattering material, 4 by 4 in., was irradiated. In these experiments a lead screen was used on top of the film, but the scattered radiation had to penetrate only one thickness of paper.

Preliminary experiments were made in which the X-ray beam was directed out of an open window. Back scatter from the air was found to be quite appreciable with the paper envelope. With the same open window arrangement an identical lead stop was placed behind the film and in contact with the envelope. It was proved that for No-screen film, photochemical halation, that is, the blackening of unexposed grains in the immediate neighborhood of heavily exposed grains, was negligible.

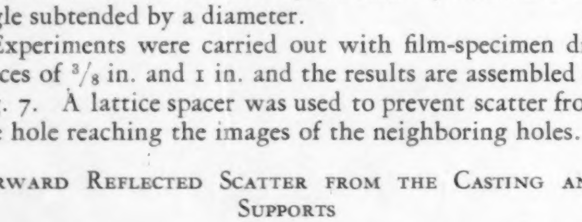


Fig. 10.—Back Scatter.

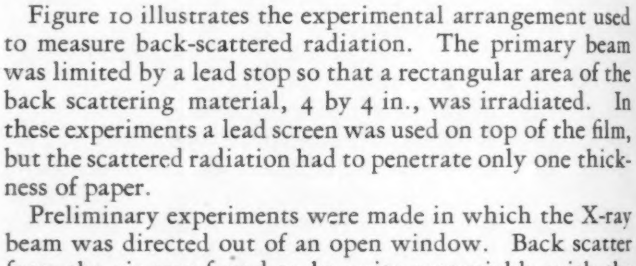


Fig. 11.

Experiments were performed in which lead, duralumin, bakelite, fluorescent screen, and copper were used as back-scattering material. The distance between the material and the film was varied from 38 in. to contact.

The film blackening was measured at points along the central axis P_1, P_2. The blackening curve (Fig. 1) was used to convert the densities into X-ray intensities and these were expressed as a fraction of the primary intensity at the film.

To express the result in a usable form, the solid angle or $\theta\varphi$ device was again used and its was shown that a back scatter coefficient could be applied to each material (Fig. 11).

Application of Scatter Measurements to Practice

In the radiography of aircraft castings, scattered radiation in any form always reduces the sensitivity of the inspection. Even the supposition that forward transmitted scatter from the upper layers of a casting will help produce an image of defects in the lower layers was shown to be misleading. In a series of calibration films of a slotted wedge penetrameter each exposure was made once with the slots in contact with the film and once with the slots remote from the film. No difference in sensitivity was detected either by eye or photometry.

Since scatter is always detrimental, X-ray technique must be designed to reduce the effect of scatter in every feasible way. The degree to which this can be done depends very greatly on the geometry of the individual casting, in fact, so greatly that it is quite essential to separate the castings into groups before proceeding to generalize about the control of scatter.

In the case of aircraft castings three groups suffice. The first, which can be called "well blocked," consists of flat castings that lie close to the cassette or castings that can be immersed in a tray of carbon tetrachloride. The second "moderately blocked" group consists of castings in which the sections have sufficient area that some loss of sensitivity around the edges is acceptable. The third "badly blocked" group consists of castings in which serious difficulty arises because thin sections scatter into the shadow of thick unblockable sections remote from the film or in which narrow strut sections or important edges such as a rim disallow loss of sensitivity around the edges.

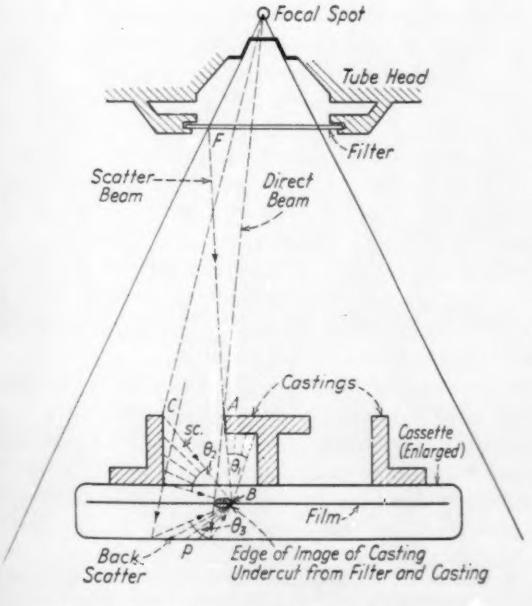


Fig. 12.—Undercut and Back Scatter.

The results presented in the sections of this paper covering forward transmitted scatter from tube windows, etc., forward reflected scatter, and back scatter show that in each of these three forms of secondary radiation the intensity is only a small fraction of the direct primary beam. Yet in some radiographs the film blackening in the image of the casting due to these forms of secondary radiation is many times greater than that due to the primary beam. This occurs because the primary beam is greatly reduced in intensity by passing through the casting, but the secondary radiation can often reach the casting image without passing through the casting.

Figure 12 illustrates the general case. The image of the point A in the casting is produced by the primary beam at B on the film. Because A is close to an edge of the casting, undercut from one side of the filter F can reach B directly. Similarly forward reflected scatter from the casting surface C and back scatter from the rectangular area P of the cassette back and shelf reach B without passing through the casting.

The ratio to the direct primary intensity I_0, of each of the radiation intensities from F, A, C, and P can be quickly estimated from the angles $\theta_1\varphi_1$, $\theta_2\varphi_2$, $\theta_3\varphi_3$. If the ratio of the direct radiation (I_0) falling onto the casting to the amount of radiation transmitted by A to B (I_T) is known, then the important ratio of the total scatter (I_S) which fogs the film at B to the primary transmitted intensity (I_T) which will produce an image of cavities can be easily ascertained.

Now consider the conditions under which X-ray apparatus is calibrated. A slotted wedge or other penetrameter is placed in immediate contact with the film and is generally surrounded by a mask. This prevents all external scatter from reaching the calibration film, but of course the internal (forward transmitted) scatter from the penetrameter itself is received by the film.

In the calibration it is essential that each slot or hole shall be remote from the edge of the penetrameter by a distance at least equal to the scatter radius (Fig. 6). Otherwise a false sensitivity will be claimed.

In the case of the image at B, the forward transmitted scatter from the casting is less than in the calibration film, and so it can be safely neglected.

The sensitivity at B can be found simply by multiplying the penetrameter sensitivity by $(I_S + I_T)/I_T$ where I_S is the total scatter intensity from F, C, and P.

It is not reasonable to expect that the radiographer will calculate the real sensitivity obtained even on every technique film, but a few calculations on typical casting patterns will form an adequate guide to his general procedure. It is very important that he should continue to study the degree to which secondary radiation invalidates the penetrameter sensitivity until he is competent to separate all his castings into the groups designated above. If he can do this satisfactorily, the calibration charts, which are the basis of his technique, can be so chosen that inspection failures due to secondary radiation are eliminated.

In the radiography of aircraft castings three types of

calibration charts are required to correspond to the three groups of castings.

These calibrations have been chosen after studying the relation of the above experiments to the practical factors of cassette design, intensifying screens, kilovoltage selection, and filtering devices.

For the group of "well-blocked" castings scatter from the window, or any object above the film, cannot reach the image of the casting without passing through the casting. The direct X-ray beam is confined to the blocked area so back scatter from the shelf or cassette back is negligible. Of course the forward transmitted scatter from the casting itself is present but only to the same degree as in the calibration penetrameter. Thus the ratio of total scatter intensity I_S to the transmitted intensity I_T in the image of the casting is the same in practice as in calibration and no adjustment is necessary.

Consistent with an exposure time suitable for mass production routine, soft X-radiation can be used to examine well-blocked castings. The sensitivity will only increase with decreasing kilovoltage so long as the change in the absorption coefficient of the radiation outweighs the increase in the forward transmitted scatter from the casting. But this point is easily checked by radiographing the same penetrameter at different kilovoltages.

With an exposure factor fixed by production conditions, fluorescent intensifying screens allow a lower kilovoltage to be used than with Noscreen film. On the other hand, Noscreen film has a higher emulsion contrast. Investigation of this point has shown that the increased sensitivity provided by the lower kilovoltage considerably outweighs the difference in emulsion contrast. For the examination of "well-blocked" aluminum alloy aircraft castings it is good practice to use an Exposure Factor of 0.17 and fast fluorescent intensifying screens and no filter.

For moderately blocked castings, scatter from the tube window or filter or other objects above the film will undercut the casting to only a negligible degree. Forward transmitted scatter from the casting itself is not much different from that for the penetrameter and it may be less. But back scatter produced by the part of the X-ray beam that passes outside the casting is very important. The danger of inspection failures due to back scatter is greatly aggravated by the use of soft unfiltered X-radiation in conjunction with unsuitable cassettes. In addition fluorescent screens increase this danger by the related film fogging due to photochemical and actinic light halation.

It is possible partly to overcome these difficulties by the use of filters. The filter does not act by preferential absorption of scattered radiation (in the kilovoltage range used for aircraft castings) but by removing much of the softer part of the primary X-ray beam. Filters increase the ratio of the transmitted intensity (I_T) which produces the useful image to the direct intensity I_O which excites the back scatter and halation. The effectiveness of filters can be ascertained by repeating the experiments described in the section on back scatter with a filter in the X-ray beam.

Unfortunately the suitable thickness of the filter depends very much on the kilovoltage and the kilovoltage varies with casting pattern. Experience has shown that mistakes will occur in the placing and removal of tube filters and in general their use is not convenient.

The alternative method of radiographing moderately blocked castings is to use Noscreen film with a back lead screen. This has proved to be an excellent practice. With the same exposure factor of 0.17 ma. sec. per f.f.d.[2] a higher kilovoltage is needed for a given thickness of casting, but the high emulsion contrast restores about half the sensitivity lost by the higher kilovoltage. The most important advantage is that the immediate contact between the opaque lead screen and the film reduces the solid angle ($\theta\varphi$) subtended by the lead scattering surface to practically zero, and therefore the film fogging due to back scatter when a back lead screen is used is practically zero.

For a badly blocked casting a choice has to be made between high sensitivity (for example 2 per cent) in well-placed sections; with very low sensitivity in badly placed sections (for example, 50 per cent); or moderate sensitivity (for example, 5 per cent) throughout. In the examination of aircraft castings the last choice is preferable.

To eliminate back scatter a back lead screen and Noscreen film must be used and of course a stop must limit the primary X-ray beam to within the cassette area. But the forward reflected scatter and transmitted scatter from thin sections of the casting must be countered by using harder X-rays, that is, the ratio I_O/I_T must be reduced by using filters and a relatively high kilovoltage.

The most convenient form of filter is a front lead foil screen in immediate contact with the film. Seemann[5] has shown that thick filters should be placed near the tube but the secondary radiation from a lead foil front screen is not objectionable.

A front lead screen produces a marked improvement for this group of castings chiefly by reducing I_O/I_T but also by a grid effect. Whereas the direct beam passing through the lead at normal incidence traverses a thickness, t, scatter passing through at an angle θ to the normal traverses a greater thickness $t \sec \theta$. The degree of improvement produced by this grid effect is shown by the dotted curve in Fig. 6.

A penetration curve type of calibration with an exposure factor of 0.01 is satisfactory for the radiography of badly-blocked aluminum alloy castings. However, most fine-focus X-ray tubes cannot be operated at a high enough voltage to penetrate more than 1½ in. of duralumin with an exposure factor as low as 0.01. So in practice it is desirable to have an exposure curve type of calibration in which penetrameter thickness is plotted against log exposure factor at the full kilovoltage of the X-ray tube and for which Noscreen film with a front lead screen 0.003 to 0.005 in. thick and a back lead screen 0.010 to 0.020 in. thick are used. This type of calibration is suitable for badly-blocked castings.

Scatter reducing grids of the Lisholm or Bucky type are not required for routine radiography of aluminum alloy castings less than 3 in. thick. The advantage to be expected from these grids can be found from a consideration of their effect on the four forms of secondary radiation described in this paper. Even a fine structure,

[5] H. E. Seemann, "The Reduction of Secondary Radiation and of Excessive Radiographic Contrast by Filtration," *Proceedings*, Am. Soc. Testing Mats., Vol. 40, p. 1289 (1940).

curved grid will not reduce scatter from the electrode, window, or tube filters. Forward transmitted scatter from the casting can be reduced and the effectiveness of the grid in this respect can be easily checked by radiographing a slotted wedge with and without the grid. Even a coarse grid can reduce considerably the undercutting scatter from sections of a casting remote from a film, but it is only a practical advantage to use a grid for this purpose when the radiographer is forced to use far too low a voltage for the casting thickness being examined. Back scatter, which is the most probable cause of a bad radiograph, is not reduced by a front grid.

Pinhole radiographing as illustrated in Fig. 2 is useful for comparing the fineness of detail that may be expected from the use of different designs of X-ray tube and tube head. Apart from the small focal spot, which is usually specified, good electrode design will reduce the radiation from the whole target face. The elimination of insulating oil and the use of suitable window material will reduce the secondary radiation from these sources and thereby reduce the undercutting of radiographic subjects of the wire mesh type.

In conclusion, it must be stressed again that the results presented in this paper refer only to aluminum alloy and one particular X-ray apparatus. However these experimental methods are now being applied to magnesium and to steel, and results for these metals will be presented in due course.

Report on Dropping Tests for Zinc and Cadmium Coatings

Prepared by W. E. Buck[1]

EDITOR'S NOTE.—This report has been submitted to Committee A-5 on Corrosion of Iron and Steel on behalf of its Subcommittee VII on Methods of Testing. It has been recommended by the committee for publication as information. It has not been acted upon officially by the Society.

FOR THE PURPOSE of determining the apparent interest in the use of dropping tests as applied to various zinc (including hot-dipped zinc) and cadmium coatings on steel sheets, hardware, etc., the following subgroup was appointed from Subcommittee VII on Methods of Testing, of Committee A-5 on Corrosion of Iron and Steel:

- W. E. Buck, chairman, Continental Steel Corp.
- R. W. Baker, Republic Steel Corp.
- G. Soderberg, Udylite Process Corp.
- E. S. Taylerson, Carnegie Illinois Corp.
- J. W. Crofoot, G. L. F. Farm Supplies
- F. L. Wolf, Ohio Brass Co.

This report has been prepared summarizing the information obtained by the subgroup.

Hot-Dipped Galvanized Sheets:

So far as can be determined "dropping tests" are at present not in general use as a method of testing hot-dipped zinc-coated (galvanized) sheets. Federal Specification QQI-696a, issued as a proposed revision of the Federal Specification for Iron and Steel; Sheet, Black and Zinc-Coated (Galvanized) QQ-I-696, provides for the use of the Hull-Strausser[2] dropping test on both hot-dipped and electroplated zinc coatings on sheet steel. This specification provides for a solution of one composition for testing hot-dipped coatings and another composition for testing electroplated coatings.

Federal Specification W-O-821b, issued as a proposed revision of Federal Specification for Outlet Boxes, Steel, with Covers and Accessories W-O-821a, provides for the use of the Hull-Strausser dropping test on hot-dipped, electroplated or sherardized zinc coatings and on electroplated cadmium coatings.

Electroplated Materials:

It was reported that dropping tests are in wide use for both electrodeposited zinc coatings and cadmium coatings on forgings, castings, and stampings, but not on sheet, strip, wire, or tubing; also that several Federal Specifications at present provide for their use on the above classes of materials.

Hardware:

Dropping tests appear to be a possible method for the determination of the thickness of coatings on hardware, for which, at present, there is no satisfactory accurate method so far as the subgroup could learn. The method is not in general use in this field and the one report received was not wholly favorable.

TRENDS

Hot-Dipped Zinc Coatings, General:

It seems quite probable that there will be greater demand for simple field acceptance tests for hot-dipped zinc coatings. This indicates the advisability of publishing some test method for field work. The dropping test appears to offer one solution; however, its limits of accuracy should be clearly defined.

Electroplated Coatings:

All indications are that dropping tests will find continued and increasing use in this field for both zinc and cadmium electrodeposited coatings.

Limitations of Dropping Tests:

Certain shapes on account of deeply recessed or cup-shaped areas do not lend themselves to use of dropping tests.

NOTE.—DISCUSSION OF THIS REPORT IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Chief Metallurgist, Sheet Division, Continental Steel Corp., Kokomo, Ind.

[2] *Monthly Review*, Am. Electroplaters Soc., Vol. 22, March, 1935, p. 9.
William Blum, P. W. C. Strausser, and Abner Brenner, "Corrosion-Protective Value of Electrodeposited Zinc and Cadmium Coatings on Steel," *Journal of Research*, Nat. Bureau Standards, Vol. 16, No. 2, p. 209 (1936), *Research Paper 867*.
A. Brenner, "Dropping Tests for Measuring the Thickness of Zinc and Cadmium Coatings on Steel," *Proceedings*, Am. Electroplaters Soc., p. 204 (1939). *Journal of Research*, Nat. Bureau Standards, Vol. 23, September, 1939, pp. 287–403 (*Research Paper R.P. 1240*).
S. G. Clarke, *Journal*, Electrodepositors Technical Soc., Vol. 8, May, 1933, Paper 11.

It may require some training to distinguish accurately the end point of some compositions of coatings on certain types of ferrous base metal.

There are inherent in dropping test methods maximum errors of plus or minus 10 per cent on electroplated coatings, and plus or minus 15 per cent on hot-dipped zinc coatings, even under conditions of careful standardization.

Dropping tests are not the best available methods for shop control in the production of hot-dipped zinc coatings on sheets, strip, wire, or tubing, and are therefore not in common use for production control.

Consideration of these limitations indicates the tolerances that should be allowed in specifications subject to field test by dropping test methods.

Dropping Test Solutions:

The S. G. Clarke solution of iodine in potassium iodide seems to have become obsolete. The Hull-Strausser solutions of acidified ammonium nitrate, while permitting a somewhat easier observation of the end point than the Brenner solution described later, have the drawback that their rate of reaction is influenced by the physical characteristics of the coating, making it necessary to use different solutions for different types of coating. This fact is recognized in the Federal Specifications mentioned previously.

The Brenner solution of chromic and sulfuric acids gives a reaction practically independent of the composition or physical characteristics found in either hot-dipped or electrodeposited zinc coatings and electrodeposited cadmium, with respect to rate of penetration, and is to be preferred.

Magnetic and Other Tests:

In the scope of work outlined, magnetic testing methods, electrolytic, micro measurements, and the chord methods also used for determining the thickness of metallic coatings were not included.

The magnetic method was discussed and some facts were brought out that the subgroup feels should be presented. So far as could be learned, the magnetic method is not at present being used extensively on hot-dipped zinc coatings, but several producers of galvanized products are experimenting with it. It is being used extensively to test the quality of electrodeposited coatings. The tendency at present is to use this method as an acceptance test, but not for rejection until the results are confirmed by other methods of testing.

The magnetic test method has the following limitations:

1. Requires smooth base and coating, cannot be used in small, deep recesses where the area is small enough to cause magnetic interference from the base metal surrounding the magnet at the sides.

2. Cannot be used on very small articles, unless specially calibrated, and

3. Requires carefully calibrated standards and magnets for different coating thicknesses.

The advantages of the magnetic method are as follows:

1. It is a nondestructive test, and

2. The apparatus is fully portable and requires no auxiliary or accessory equipment.

Due to the fact that there is a real demand for a method of field testing of zinc-coated and cadmium-coated products, and that such methods are being incorporated in specifications by some specification writers, it would appear to be desirable for the committee to investigate thoroughly the limitations of the various methods of field testing so that the Society may go on record as either approving or disapproving the various types of tests that are now being written into specifications by various specification writing bodies.

This work should not be confined exclusively to dropping tests.

Wide Acceptance of Standard on Steel Construction

A pamphlet recently issued by the American Institute of Steel Construction indicates that the A.I.S.C. specifications for the design, fabrication, and erection of structural steel for buildings has been very widely adopted. Over 265 cities and 14 governmental bodies have adopted or permitted use of the specification incorporating an allowable basic working stress for structural steel for building of 18,000 psi. In addition, and to effect a more economical and efficient use of structural steel, 429 cities and 20 public bodies have adopted or permitted the use of the 20,000 psi. basic stress specification in their codes.

This specification and the other A.I.S.C. standards, as well as certain A.S.T.M. specifications are published in the A.I.S.C. Manual. The A.S.T.M. Specifications for Steel for Bridges and Buildings (A 7 – 39) and for Structural Rivet Steel (A 141 – 39) are incorporated in the materials section of the design specifications and it is indicated that alloy steels, cast steel, cast iron, and other metals are to conform to the applicable A.S.T.M. specifications as amended to date.

Wanted—Comments on Proposed Standards

If anything is definite today—and there are still a few things that can be safely placed in this category—one is the importance in the present emergency of standardization and simplification. It is considered important that the Society's standardization work in engineering materials be continued and expanded. There are many ramifications in this work and certain principles must be constantly observed. One of the basic principles underlying the development of A.S.T.M. standards is that *everyone* interested in a specification or test method shall have an opportunity to participate in its development.

One purpose in issuing proposed standards in tentative form is to elicit constructive criticism and comment, of which the standing committees in charge take due cognizance before recommending adoption as a formal standard. In this connection each A.S.T.M. member can be of service by reviewing critically tentative standards in which he or his company is interested or by bringing them to the attention of other interested parties, to the end that a standard will finally be adopted which will represent a true consensus of industry, be practical, complete, and authoritative. Comments should be forwarded to A.S.T.M. Headquarters.

Hardness Conversion Relations for Cartridge Brass

By J. R. Townsend[1]

A SPECIAL SUB-SUBCOMMITTEE under the Section on Indentation Hardness, of Committee E-1 on Methods of Testing, consisting of R. L. Kenyon, chairman, V. E. Lysaght, C. H. Davis, and W. E. Ingerson was formed to study hardness conversion relations for various materials. In view of the pressing need for such information on cartridge brass at the present time, hardness conversion relations for this material have been prepared first. It is planned subsequently to prepare similar hardness conversion tables for heat-treated steels and possibly other materials.

The hardness conversion tables for cartridge brass are the result of a series of round-robin tests conducted at the laboratories of Frankford Arsenal, American Brass Co., American Rolling Mill Co., Wilson Mechanical Instrument Co., and Bell Telephone Laboratories. A set of sixteen blocks of various tempers of cartridge brass was sent to each cooperating laboratory. These blocks were prepared by the American Brass Co. At each laboratory a minimum of five, usually ten, readings were made on each block using each of the following scales:

Diamond pyramid hardness, 10 kg., 20 kg., and 30 kg.
Rockwell hardness, B and F scales; superficial scales 15-T, 30-T, and 45-T

Brinell hardness tests using 500-kg. load were made on the blocks which had sufficient hardness and thickness so as to avoid anvil effect.

These test data were compared with experience data on similar material which had been collected over a period of time at the various laboratories. On certain of the hardness scales, these experience data represent a very large number of readings. In so far as the same scales were covered, the present test results check very satisfactorily with experience data.

At a meeting of the Section on Indentation Hardness held in Cleveland, Ohio, on March 4, a hardness conversion table for cartridge brass was approved for presentation to the Society in June for publication as an A.S.T.M. Standard. In order to make this information available immediately the proposed hardness conversion table is appended to this report.

NOTE.—DISCUSSION OF THIS REPORT IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 S. Broad St., Philadelphia, Pa.

[1] Chairman, Section on Indentation Hardness, of Committee E-1 on Methods of Testing; Materials Standards Engineer, Bell Telephone Laboratories, Inc., New York, N. Y.

APPENDIX

PROPOSED HARDNESS CONVERSION TABLE FOR CARTRIDGE BRASS[1]

(RELATIONS BETWEEN DIAMOND PYRAMID HARDNESS, ROCKWELL HARDNESS, AND BRINELL HARDNESS)

This proposed conversion table is published as information only. Comments are solicited and should be addressed to the American Society for Testing Materials, 260 S. Broad St., Philadelphia, Pa.

Scope

1. This conversion table presents data on the relationship among diamond pyramid hardness, Rockwell hardness, and Brinell hardness of cartridge brass.

NOTE.—These hardness conversion relations are intended to apply particularly to cartridge brass conforming to the Tentative Specifications for Cartridge Brass Sheet, Strip, and Disks (A.S.T.M. Designation: B 19)[2] and for the Tentative Specifications for Cartridge Brass Cartridge Case Cups (A.S.T.M. Designation: B 129)[3] of the American Society for Testing Materials.

Hardness Determinations

2. (*a*) Hardness of the cartridge brass shall be determined in accordance with one of the following methods.

(*b*) *Diamond Pyramid Hardness.*—Diamond pyramid hardness is determined by forcing a square base diamond pyramid having an apex angle of 136 deg. into the specimen under loads usually of 5 to 50 kg., and measuring the diagonals of the recovered indentations. The diamond pyramid hardness is defined as the load per unit area of surface contact in kilograms per square millimeter as calculated from the average diagonal, as follows:

$$\text{D.P.H.} = \frac{2L \sin \frac{a}{2}}{d^2}$$

where: D.P.H. = diamond pyramid hardness,
d = length of average diagonal in millimeters,
a = apex angle = 136 deg., and
L = load in kilograms.

(*c*) *Rockwell Hardness.*—Standard Method of Test for Rockwell Hardness of Metallic Materials (A.S.T.M. Designation: E 18 – 36), Scales B and F, of the American Society for Testing Materials.[4]

(*d*) *Rockwell Superficial Hardness.*—Tentative Method of Test for Rockwell Superficial Hardness of Metallic

[1] This proposed conversion table is under the jurisdiction of the A.S.-T.M. Committee E-1 on Methods of Testing.

[2] 1941 Supplement to Book of A.S.T.M. Standards, Part I, p. 484.

[3] 1940 Supplement to Book of A.S.T.M. Standards, Part I, p. 425.

[4] 1939 Book of A.S.T.M. Standards, Part I, p. 743.

TABLE I.—PROPOSED HARDNESS CONVERSION TABLE FOR USE ON BRASS (70 PER CENT COPPER, 30 PER CENT ZINC ALLOY).

Diamond Pyramid Hardness Number	Rockwell Hardness Number: B Scale, 100-kg. Load, 1/16-in. Ball	Rockwell Hardness Number: F Scale, 60-kg. Load, 1/16-in. Ball	Rockwell Superficial Hardness Number: 15-T Scale, 15-kg. Load, 1/16-in. Ball	Rockwell Superficial Hardness Number: 30-T Scale, 30-kg. Load, 1/16-in. Ball	Rockwell Superficial Hardness Number: 45-T Scale, 45-kg. Load, 1/16-in. Ball	Brinell Hardness Number: 500-kg. Load, 10-mm. Ball
45	..	40.0	..	..	..	42
46	..	43.0	..	..	..	43
47	..	45.0	..	..	..	44
48	..	47.0	53.5	..	..	45
49	..	49.0	54.5	..	..	46
50	..	50.5	55.5	..	..	47
52	..	53.5	57.0	..	..	48
54	..	56.5	58.5	12.0	..	50
56	..	58.8	60.0	15.0	..	52
58	..	61.0	61.0	18.0	..	53
60	10.0	63.0	62.5	20.5	..	55
62	12.5	65.0	63.5	23.0	..	57
64	15.5	66.8	65.0	25.5	..	59
66	18.5	68.5	66.0	28.0	..	61
68	21.5	70.0	67.0	30.0	..	62
70	24.5	71.8	68.0	32.0	..	63
72	27.5	73.2	69.0	34.0	..	64
74	30.0	74.8	70.0	36.0	1.0	66
76	32.5	76.0	70.5	38.0	4.5	68
78	35.0	77.4	71.5	39.5	7.5	70
80	37.5	78.6	72.0	41.0	10.0	72
82	40.0	80.0	73.0	43.0	12.5	74
84	42.0	81.2	73.5	44.0	14.5	76
86	44.0	82.3	74.5	45.5	17.0	77
88	46.0	83.5	75.0	47.0	19.0	79
90	47.5	84.4	75.5	48.0	21.0	80
92	49.5	85.4	76.5	49.0	23.0	82
94	51.0	86.3	77.0	50.5	24.5	83
96	53.0	87.2	77.5	51.5	26.5	85
98	54.0	88.0	78.0	52.5	28.0	86
100	56.0	89.0	78.5	53.5	29.5	88
102	57.0	89.8	79.0	54.5	30.5	90
104	58.0	90.5	79.5	55.0	32.0	92
106	59.5	91.2	80.0	56.0	33.0	94
108	61.0	92.0	..	57.0	34.5	95
110	62.0	92.6	80.5	58.0	35.5	97
112	63.0	93.0	81.0	58.5	37.0	99
114	64.0	94.0	81.5	59.5	38.0	101
116	65.0	94.5	82.0	60.0	39.0	103
118	66.0	95.0	82.5	60.5	40.0	105
120	67.0	95.5	..	61.0	41.0	106
122	68.0	96.0	83.0	62.0	42.0	108
124	69.0	96.5	..	62.5	43.0	110
126	70.0	97.0	83.5	63.0	44.0	112
128	71.0	97.5	..	63.5	45.0	113
130	72.0	98.0	84.0	64.5	45.5	114
132	73.0	98.5	84.5	65.0	46.5	116
134	73.5	99.0	..	65.5	47.5	118
136	74.5	99.5	85.0	66.0	48.0	120
138	75.0	100.0	..	66.5	49.0	121
140	76.0	100.5	85.5	67.0	50.0	122
142	77.0	101.0	..	67.5	51.0	124
144	77.5	101.5	86.0	68.0	51.5	126
146	78.0	102.0	..	68.5	52.5	128
148	79.0	102.5	..	69.0	53.0	129
150	80.0	...	86.5	69.5	53.5	131
152	80.5	103.0	..	..	54.0	133
154	81.5	103.5	..	70.0	54.5	135
156	82.0	104.0	87.0	70.5	55.5	136
158	83.0	104.5	..	71.0	56.0	138
160	83.5	...	..	71.5	56.5	139
162	84.0	105.0	87.5	..	57.5	141
164	85.0	105.5	..	72.0	58.0	142
166	85.5	...	..	72.5	58.5	144
168	86.0	106.0	88.0	73.0	59.0	146
170	87.0	...	..	..	59.5	147
172	87.5	106.5	..	73.5	60.0	149
174	88.0	...	88.5	74.0	60.5	150
176	88.5	107.0	..	..	61.0	152
178	89.0	...	..	74.5	61.5	154
180	90.0	107.5	..	75.0	62.0	156
182	90.5	108.0	89.0	..	62.5	157
184	91.0	...	..	75.5	63.0	159
186	91.5	108.5	..	76.0	63.5	161
188	92.0	...	89.5	..	64.0	162
190	92.5	109.0	..	76.5	64.5	164
192	93.0	...	..	77.0	65.0	166
194	..	109.5	..	..	65.5	167
196	93.5	110.0	90.0	77.5	66.0	169

Materials (A.S.T.M. Designation: E 18 – 39 T), Scales 15-T, 30-T, and 45-T, of the American Society for Testing Materials.[5]

(*e*) *Brinell Hardness*.—Standard Method of Test for Brinell Hardness of Metallic Materials (A.S.T.M. Designation: E 10), 500-kg. load, of the American Society for Testing Materials.[6]

[5] 1939 Book of A.S.T.M. Standards, Part I, p. 1238.
[6] 1939 Book of A.S.T.M. Standards, Part I, p. 737.

Use of Conversion Table

3. The values in Table I are recommended for use in converting the results of one form of hardness test to another only when the specific test procedures and precautions outlined in the several hardness test methods referred to in Section 2 are followed. These conversion values are applicable only in the case of hardness test results obtained on flat specimens of cartridge brass of sufficient thickness so as to avoid anvil effect, which thickness is roughly ten times the depth of indentation.

Cleveland Technical Societies Council

Technical and engineering societies of Northern Ohio have cooperated in organizing a Cleveland Technical Societies Council. The movement has resulted from a distinct feeling of need on the part of engineers, local and national, for the coordination of the efforts of engineers and for means whereby these societies and their members may best assist in the war effort.

There have been many conflicts in the meeting dates of some of the various organizations and consequent duplication of meeting notices. A "Meetings Coordination Committee" has been set up to handle this situation. It is recognized that there is a real need for cooperative sponsorship of joint meetings and a "Joint Meetings Committee" is included for the purpose of reducing the number of meetings.

There are many problems common to all such societies and their members, the most pressing at the moment being the means whereby these societies and their members may best assist in the war effort. The "War Production Technical Advisory Board" has been organized from the joint membership to handle this activity.

The following societies comprise the membership of the Council:

American Chemical Society
American Institute of Architects
American Institute of Mining and Metallurgical Engineers
American Institute of Electrical Engineers
American Institute of Chemical Engineers
American Society of Civil Engineers
American Society of Heating and Ventilating Engineers
American Society of Mechanical Engineers
American Society of Refrigerating Engineers
American Society for Testing Materials
American Society of Tool Engineers
American Welding Society
Architects Society of the State of Ohio
Association of Iron and Steel Engineers
Cleveland Engineering Society
Cleveland Society of Professional Engineers
Electro-Chemical Society
Illuminating Engineering Society
Institute of Radio Engineers
Society of American Military Engineers—Cleveland Post
Society of Automotive Engineers
Society for the Advancement of Management

Report of Hardness Test Section of Technical Committee A on Automotive Rubber, Committee D-11 on Rubber Products

By L. V. Cooper,[1] Chairman

When the Hardness Test Section of Technical Committee A on Automotive Rubber, of Committee D-11 on Rubber Products, was originally formed, it was assigned the task of developing a portable rubber hardness testing device which would be more suitable and reliable than present instruments. Some progress has been made along this line of endeavor, but due to the present emergency, it is impossible to bring the work to a conclusion. Meanwhile, in order that some standardization of rubber hardness evaluation might be possible, the Section, on instructions from Technical Committee A, has drawn up the Proposed Method of Test for Indentation of Rubber by Means of the Durometer which appears in an Appendix to this report. In the proposed method the physical characteristics of an acceptable durometer and the proper procedure for its use are described. The committee plans to recommend this proposed method to the Society for publication later as an Emergency Standard. When conditions are more favorable, it is definitely the intention of the committee to resume work on the original program.

NOTE.—DISCUSSION OF THIS REPORT IS INVITED, either for publication or for the attention of the author. Address all communications to A.S.T.M. Headquarters, 260 So. Broad St., Philadelphia, Pa.

[1] In Charge of Testing Laboratories, The Firestone Tire and Rubber Co., Akron, Ohio.

The Hardness Test Section realizes that the durometer at best is a fragile instrument which is difficult to calibrate, but it is the instrument most generally in use. Satisfactory results may be obtained on a commercial basis with a reasonably correct durometer if it is checked at frequent intervals with a durometer that has been correctly calibrated and held as a standard.

The chairman of the section wishes to acknowledge the very helpful and conscientious work of the following members of the section:

Lewis Larrick, B. F. Goodrich Co.

B. P. Resseger, B. F. Goodrich Co.

E. G. Kimmich, The Goodyear Tire and Rubber Co.

J. C. Dudley, Chrysler Corp.

G. P. Bosomworth, The Firestone Tire and Rubber Co.

APPENDIX

PROPOSED METHOD OF TEST FOR INDENTATION OF RUBBER BY MEANS OF THE DUROMETER

Scope

1. This proposed method of test covers the procedure for determining the indentation of rubber by means of the durometer.

Apparatus

2. (*a*) *Indentor Point.*—The indentor point shall be made of hardened steel and shall conform to the shape and size shown in Fig. 1.

(*b*) *Calibrated Spring.*—The spring in the durometer shall be such that when it is calibrated in accordance with the procedure described in the paper on "The Standardization of Durometers," by Lewis Larrick[2] the calibration curve shall conform to a straight line, one end of which is

[2] *Proceedings*, Am. Soc. Testing Mats., Vol. 40, p. 1239 (1940).

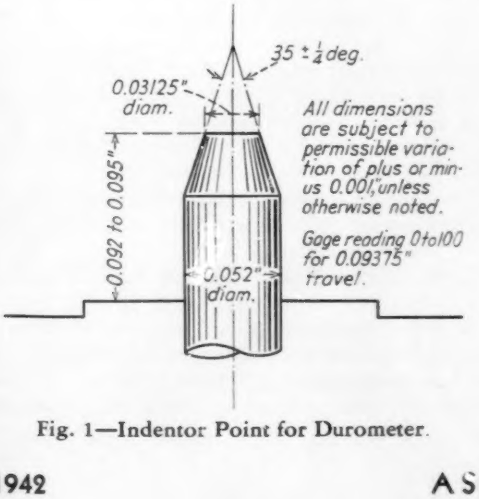


Fig. 1—Indentor Point for Durometer.

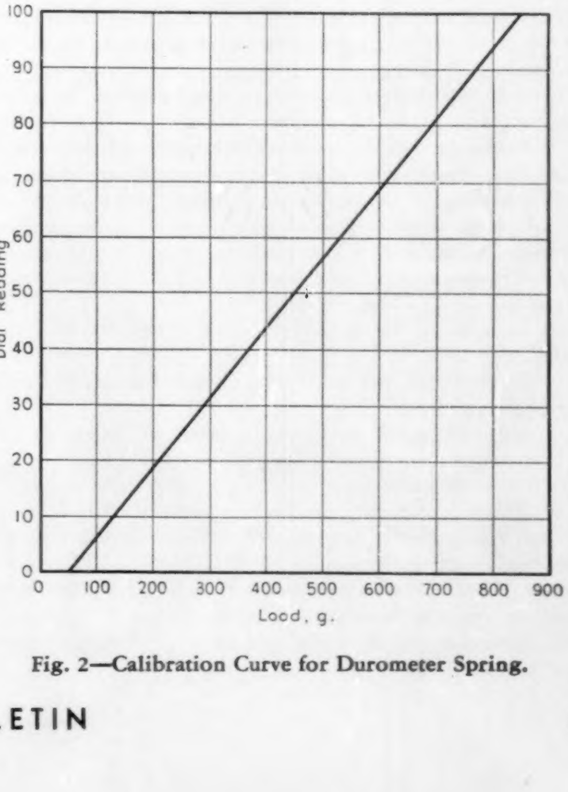


Fig. 2—Calibration Curve for Durometer Spring.

at zero dial reading and 50-g. load and the other end at 100 dial reading and 850-g. load, as shown in Fig. 2. A variation of plus or minus 4 g. from the straight line shall be permitted at any or all points.

Test Specimens

3. Test specimens shall be at least $^1/_4$ in. in thickness. Thinner samples may be plied up to obtain this thickness, but hardness determinations made on such specimens shall be considered only indicative and not definite. No hardness determination shall be made within $^1/_2$ in. of the edge of the specimen and under no circumstances shall hardness determinations be considered practical unless the entire width of the bearing plate is resting on the specimen. A suitable hardness determination cannot be made on a rounded surface or on one that is narrower than the bearing plate.

Procedure

4. (*a*) *Method of Application of Durometer to the Specimen.*—The durometer shall be grasped between the thumb and the third and fourth finger, resting the index finger on top of the instrument. The durometer shall then be placed on the test specimen while keeping the base of the instrument parallel to the surface of the specimen. This method of application allows the seating of the plate around the indentor point flush with the test surface with a minimum amount of rocking.

(*b*) *Pressure Application.*—The test pressure applied shall be just sufficient to insure firm contact of the pressure plate with the test specimen.

(*c*) *Time of Reading.*—The durometer indentation reading shall be taken as soon as the indicating hand of the dial comes to rest or, if this is not possible, at the moment when a definite change in needle speed is noted; but in no case shall the period of application of the test pressure be longer than 10 sec.

Conservation of Critical Materials Approved by State Highway Officials' Association

CHANGES IN design and construction standards for the conservation of critical materials have been approved by the Executive Committee of the American Association of State Highway Officials upon recommendation of its Committee on Standards. The announcement as reprinted in *Highway Research Abstracts* states:

"Upon recommendation of the Committee on Standards of the association, the Executive Committee of the American Association of State Highway Officials, after consultation with the Federal Office of Production Management, hereby promulgates changes in association design and construction standards due to the necessity for the conservation of critical materials during the national emergency.

"The objective of these changes is hoped to be attained by the adoption of designs which reduce or eliminate critical materials in construction projects by the substitution of non-critical materials wherever possible, and by simplification of standards and specifications to reduce the number of sizes and shapes of critical materials.

"The critical materials principally involved in road and bridge construction are copper, zinc, steel alloys, carbon steel, and other iron products.

"The following changes in specifications for bridges and structures are recommended:

"1. Reduce the allowable unit working stress of concrete f_c to 700 psi., this working stress to apply to all classes of concrete which have an ultimate compressive strength of 2400 psi. or better. Some economy can be gained by reducing the amount of cement required in the richer mixes now used. An exception to this would be where it would increase the dead load to such an extent as to require a greater amount of steel, such as a concrete slab on a long steel span.

"2. Use a value of $n = 10$ for most concrete and 8 if 4000-lb. concrete is secured.

"3. Use reinforced concrete in place of steel in bridge guardrails, I-beam, spans, etc.

"4. Make full use of the composite action of concrete floors and beams by using mechanical anchors between floor and beams.

"5. Use an allowable working stress f_s for reinforcing steel of 22,000 psi. in culverts, abutments, piers, columns and practically all substructures, specifying intermediate grade steel. This would probably call for a more liberal use of water-proofing.

"6. Replace heavy steel expansion dams where practicable, with lighter steel design and concrete cross beams.

"7. Discourage the use of steel grid floors except in repair jobs and movable spans.

"8. Eliminate the use of copper water stops, bronze expansion plates or any copper alloy. Sheet lead can be substituted in some cases.

"9. Eliminate the use of aluminum paint and all galvanizing except perhaps galvanized cables and hardware in timber bridges.

"10. Eliminate the use of all alloy steels, including silicon.

"11. Eliminate the use of steel bearing piles for friction piles.

"12. Make greater use of treated timber.

"13. Substitute small concrete culverts or concrete pipe in place of corrugated iron pipe culverts.

"14. Avoid the addition of reinforcing steel to take compressive stresses in concrete members.

"15. Repair existing structures, if practicable, rather than replace them with new structures.

The announcement further stated:

"There is need for the reduction or elimination of steel from concrete pavements and for the substitution of masonry, unreinforced concrete, or concrete or clay pipe for galvanized metal culverts.

"The use of reinforcement in concrete pavement can be eliminated by the substitution of nonreinforced slabs for reinforced slabs. When such substitution is made it will be necessary to use slab lengths consistent with the design of nonreinforced concrete slabs. In slabs with thickened edges, dowels or other low transferring devices are required at transverse joints. By substituting pavement slabs of uniform thickness for slabs with thickened edges, a reduction of steel across joints may be made inasmuch as provision for load transfer is not required, and only enough steel is necessary across joints to maintain alignment.

"The elimination of galvanized metal culverts is for the purpose of conserving zinc and iron products. As substitutes for these pipe culverts, box culverts of equivalent capacity are recommended. Such culverts may be constructed with masonry or mass concrete side walls, and with mass or lightly reinforced concrete or arched tops depending upon span and available head rooms. Concrete or clay pipe may also be used.

"Wherever possible in designs calling for reinforced concrete, substitution of miscellaneous sizes of reinforcing bars instead of design sizes is recommended, in order to utilize such local or regional stocks as may be available, making in the design such redistribution of the steel as use of the miscellaneous sizes available may require.

"In all new designs involving unavoidable reinforcing, simplification of sizes of reinforcing steel is to be secured by using only $^1/_4$-in., $^1/_2$-in., $^3/_4$-in., 1-in., and $1^1/_4$-in. deformed rounds.

"To conserve copper, it is further recommended that lighting projects be entirely eliminated.

"It is understood that the changes in design and practice resulting from the above suggestions and recommendations, when submitted in connection with federal-aid projects, will be acceptable as emergency standards and practice wherever they are in conflict with existing association standards."

Rubber, Gasoline, Materials Standards, Topics at Pittsburgh Meeting

Under the auspices of the A.S.T.M. Pittsburgh District Committee there is being held on Monday, March 30, in the auditorium of Mellon Institute a meeting featuring talks on three subjects of paramount importance in the war program—rubber, gasoline, and materials standards. Three outstanding authorities will speak at the meeting. Dr. G. E. F. Lundell, the Society's President, and Chief, Chemistry Division, National Bureau of Standards, will talk on materials standards in the war effort, in the course of his address outlining some of the important A.S.T.M. efforts. Two specific materials also will be covered. Arthur W. Carpenter, Consultant, Conservation and Substitution Branch, Bureau of Industrial Conservation who is serving in WPB work on leave from his position as Manager of Testing Laboratories, The B. F. Goodrich Co., will cover rubber, and Mr. Whitney Weinrich, Assistant Head, Chemistry Division, Gulf Research and Development Co., will discuss gasoline.

Following these addresses it is expected there will be a showing of the movie, "Unfinished Rainbows," featuring the story of aluminum. F. M. Howell, Chairman of the Pittsburgh District Committee, and H. A. Ambrose, Secretary, are in charge of the plans for the meeting. Further details have been sent to each A.S.T.M. member of the Pittsburgh District and members of other societies and clubs in Western Pennsylvania.

Philadelphia Meeting on Textiles and Rubber

Under the auspices of the A.S.T.M. Philadelphia District Committee there is being held at the Engineers' Club on Thursday evening, April 30, a technical meeting to which all of the engineers and technologists in the Philadelphia area are invited. Two outstanding authorities will discuss topics of widespread interest. Dean M. E. Heard, Philadelphia Textile School, will discuss "Textiles and the War" and O. M. Hayden, Manager, Rubber Chemicals Division, E. I. du Pont de Nemours and Co., will discuss "Rubber and the War."

Another feature will be a showing of the sound film "Unfinished Rainbows" giving the story of aluminum.

Preceding the technical session which is scheduled for 8 o'clock will be an informal dinner at the Club. Members and guests are asked to convene at 6:30.

Alexander Foster, Jr., Vice-President, Warner Co., is to preside at the meeting. In addition to F. G. Tatnall, chairman, and R. W. Orr, secretary of the District Committee, the following members are active: J. F. Vogdes, L. H. Winkler, Tinius Olsen, 2d, E. J. Albert, W. H. Harman, Jr., and A. O. Schaefer.

Joint Meeting on Physics of Pigments and Glasses

Under the joint sponsorship of the Department of Physics, University of Pennsylvania, and the A.S.T.M. Philadelphia District Committee there is being held on Friday and Saturday, May 15 and 16, in Houston Hall, University of Pennsylvania, a Symposium on the Physics of Pigments and Glasses. Leading technical authorities will prepare papers, and invitations are being extended to a large number of physicists, engineers, and other scientists concerned with the problems to be covered. Dr. Frederick Seitz at the University is Chairman of the joint committee in charge of the meeting and the following representatives of the A.S.T.M. have cooperated closely:

J. T. Littleton, Assistant Director of Research, Corning Glass Works, representing Committee C-14 on Glass and Glass Products.

Dr. Clinton Grove, Technical Service Division, United Color and Pigment Co., representing Committee D-1 on Paint, Varnish, Lacquer, and Related Products.

Dr. W. T. Pearce, Resinous Products and Chemical Co., representing Philadelphia District Committee.

At the informal dinner in Houston Hall on Friday evening, to which all A.S.T.M. members and others are invited to attend, there will be a welcome by Dr. T. S. Gates, President of the University, or his representative, and a short address by some outstanding technical authority. Details of the technical program follow:

Friday, May 15, 1942, 3:00 p.m.

Chairmen: E. R. Allen, Krebs Pigment Co., Newark, N. J.; J. T. Littleton, Corning Glass Works, Corning, N. Y.

Introduction—G. P. Harnwell, Director, Physics Laboratory, University of Pennsylvania, Philadelphia, Pa.

1. The Basic Principles Involved in the Preparation of Pigments, R. H. Sawyer, Krebs Pigment and Color Corp., Baltimore, Md.
2. The Basic Principles Involved in the Glassy State, B. E. Warren, Massachusetts Institute of Technology, Cambridge, Mass.

Friday, May 15, 1942, 8:30 p.m.

Chairmen: Clinton Grove, United Pigment and Color Co., Newark, N. J.; E. C. Bingham, Lafayette College, Easton, Pa.

3. The Electron Microscope and the Determination of Particle Size, R. B. Barnes, American Cyanamid Co., Stamford, Conn.
4. The Physics of Pigments in Dispersed Systems, H. Green, The Interchemical Corp., New York, N. Y.

Informal Dinner in Houston Hall for persons attending the Conference, 6:00 p.m.

Saturday, May 16, 1942, 10:00 a.m.

Chairmen: F. C. Flint, Hazel-Atlas Glass Co. Washington, Pa.; J. E. Bailey, Plax Corp., Hartford, Conn.

5. The Mechanical Properties of Glasses, F. W. Preston, The Preston Laboratories, Butler, Pa.
6. Combined Glass-Pigment Systems, C. Robertson, R and H Division, E. I. du Pont de Nemours and Co., Inc., Perth Amboy, N. J.
7. Deterioration of Materials by Light, Frederick Seitz, Randal Morgan Laboratory, University of Pennsylvania, Philadelphia, Pa.

This is the second in a series of this type to be sponsored under the joint auspices of the University of Pennsylvania and a technical society. Last year the University and the American Society for Metals, Philadelphia Chapter, sponsored a meeting on Hardening of Metals in which meeting quite a number of A.S.T.M. members took part. In the near future, A.S.T.M. members and others in the Philadelphia area will receive a copy of the program and a reservation card for the dinner ($1.50) and other details.

ASTM Bulletin

MARCH 1942

NO. 115

TWO-SIXTY
SOUTH BROAD ST.
PHILADELPHIA, PENNA.

Another Annual Meeting

It will be noted from an article elsewhere in this issue that the A.S.T.M. is looking forward to an interesting and extensive 1942 meeting. Aside from the strong technical program in store, as indicated, and which will be more apparent from the May Bulletin when the Provisional Program is published, a few notes about the meeting seem in order.

A leading weekly engineering magazine has asked on its editorial page "Are Conventions Justified?" Such a question is quite in order because as this writer pointed out, there must be merciless weeding out of activities not essential to the war effort and the justification of "national conventions of engineering societies" demands close scrutiny. In another society journal, it is reported that many functions of this organization are to be subordinated or eliminated to direct thinking along the lines of our country's struggle.

If the A.S.T.M. Annual Meeting could be considered a so-called "convention" and the results of the meetings did not have a constructive effect, unquestionably those responsible for Society activities—the Executive Committee—would cancel the meeting promptly. *But there has been no such thought raised at any recent meetings or in Committee E-6 on Papers and Publicatioms* for a number of reasons. First, the Society's meeting is definitely a business meeting as almost any member and committee member will testify. With more than 200 committee meetings throughout the week, mixed in as judiciously as possible with the some 18 to 20 technical sessions, there has not been in the past and certainly will not be this year much time for "conventioneering."

The annual meeting is the Society's business session at which it acts formally on recommendations from its standing technical committees on proposed specifications and test methods and approves for publication the results of the ramified research programs under way in almost every phase of materials.

This year the meeting will provide another opportunity, as did A.S.T.M. Committee Week (see extensive article in this Bulletin), for committees to review, as they must now constantly do, the standards to determine if they should be modified either in regular procedure or as emergency to provide our country with the best possible code of practice.

It is extremely significant that widespread recognition of the Society's place as an important forum for the discussion of properties and tests of materials is as much in evidence this year as in any previous time—there are as many technical papers accepted as in any recent period. Many of these will provide data invaluable in the war effort. To cite an example—the Symposium on Radiography.

And one more point needs comment, although we have long since given up any hope of expressing adequately its significance—namely, the exchange between one materials technologist and another and between groups, of information on "how to do this" and "how to do that" and "how we handled this problem"—discussions of a real practical nature which can only come about when men in a serious mien discuss frankly the serious problems they have. Hundreds of such discussions and informal conferences will mark the A.S.T.M. Annual Meeting this year as they always have.

We have recorded these thoughts not to justify the annual meeting—it needs no justification—but to urge every member if at all possible to plan to be there for a day or two or more and to bring with him, if possible, some of his associates so that they can receive some of the inspiration from various parts of the meeting. Each will go away better fitted in some way to do the job he has to do and which rests on the shoulders of America's materials technologists as it does on no other group.

Personnel and the War

The "Personals" column in this Bulletin notes the transfer of a number of leading technologists from industrial and related occupations to Army or War Production Board positions. Note we didn't say from industrial to *war* jobs, because with the present type of all-out warfare technical men in industry may very well be contributing as much to the war effort as those nearer the actual firing lines. How trite to repeat again the oft-repeated statement—this is a war of materials!

The Government is seeking professional engineers—any kind—and in large numbers—and unfortunately industry has need of many more too. It poses difficult problems individually—and to those in responsibility—to decide where a technical man's talents can best serve.

It has been our observation that the technical men in Washington are doing a very intensive job, and many working probably the hardest they ever have—not because they are earning high salaries (Civil Service in which most men are now classified will vouch for that!) or because they love the work, but because they're honest enough to do the best they can. The same goes for the technical men in industry—you don't have to go to Washington to work hard—any A.S.T.M. member will agree on that in these times!

The civil engineer with his roads and bridges may feel he occupies a most important place in the war effort; the mechanical engineer with his design of combat machinery may realize his important place; and certainly, the automotive and aeronautical engineer has to propel the airplane or tank where it can do its job; the electrical engineer must provide power so that there can be production; and the ceramic, metallurgical, and mining engineers are all doing important jobs—*and each one is concerned with materials.* The fact is that this emergency is calling upon the engi-

neering talents as never before and we hope never will need to again, and whether a man is a civil, mechanical, or mining engineer makes little difference at the moment. Engineers by and large must win this war and when it is over, they should see that we do not have another one for a long, long time.

1942 Nominating Committee

After reviewing the report of the tellers, J. F. Vogdes, Jr., Engineer, Day & Zimmerman, Inc., and L. F. Parlette, Assistant Chief Engineer, Philadelphia Transportation Co., on the recommendations of members for appointments on the 1942 Nominating Committee, the Executive Committee at its January meeting selected members of the committee. A meeting of the Nominating Committee was held in Philadelphia at A.S.T.M. Headquarters on March 6, with the following designated members present:

R. H. Heilman	R. L. Templin
J. J. Shuman	H. S. Vassar
F. G. Tatnall	G. E. Warren

Past-Presidents T. D. Delbridge and H. H. Morgan were also present as *ex-officio* members of the Nominating Committee in accordance with the By-laws which provide that it shall include the three last past-presidents. Past-President W. M. Barr was unable to attend.

Following the established procedure, the nominees for president, vice-president, and five new members of the Executive Committee will be announced in the May Bulletin.

Procedure for Complete Emergency Standards

By action of the Executive Committee at its January meeting, the emergency procedure which heretofore has been available for *emergency alternate modifications* or *emergency alternate standards* has been extended to cover the development of complete new *emergency standards* irrespective of whether the Society has an existing standard on the subject. Under this procedure, standing committees may develop complete specifications covering materials that may be considered as substitutes for other standard materials, but which are not available due to present stringencies. For example, one such emergency specification, as referred to elsewhere in this Bulletin, covers lead-coated and lead-alloy coated copper wire which material may be used in lieu of the tin-covered wire which has been employed heretofore. It is expected that many of the Society's committees may wish to make use of this new procedure. This procedure for a complete new emergency standard is in line with the desire of the Society to make its facilities of maximum utility in the present emergency.

Cotton Yarn Appearance Standards

The Cotton Yarn Appearance Standards, developed jointly by the Society and the Agricultural Marketing Administration, U. S. Department of Agriculture, for use with the A.S.T.M. Standard General Methods of Testing and Tolerances for Cotton Yarns (D 180) are now being produced by the Society and may be secured from A.S.T.M. Headquarters. They were formerly available from the Department of Agriculture, but this service had to be discontinued and the Society was asked to reproduce the charts and market them.

The set of standards consists of twenty $5^1/_2$ by 10-in. photographs, representing four grades each of five groups of yarn numbers. The standards for each group are mounted on a board $27^1/_2$ by 15 in. The grouping of yarn numbers covered by the five boards is as follows:

3.0s to 7.0s	16.5s to 32.0s
7.0s to 16.5s	32.0s to 65.0s
65.0s to 125.0s	

The cotton yarn appearance standards may be secured from A.S.T.M. Headquarters at $10 per set. Standards for single groups are available at $2.50 per board.

New Tentative Standard Published

The Society has recently issued one new tentative specification and a revision of a tentative method of test by action of Committee E-10 on Standards. This brings the total number of ASTM tentative standards to 395 and the number of standards and tentative standards to 1045.

The new Tentative Specifications for Copper Alloy Condenser Tube Plates (B 171 – 42 T) were prepared by Committee B-5 on Copper and Copper Alloys. Five different alloy compositions are covered: namely, Muntz metal, naval brass, admiralty metal, 70 per cent copper, 30 per cent nickel alloy, and aluminum bronze. Four of these compositions are being covered in A.S.T.M. specifications for the first time; the requirements for Muntz metal are identical with the present Standard B 57 – 27, which is later to be withdrawn.

Copper alloy tubes of this type are extensively used in surface condensers and heat exchangers and these new specifications will accordingly be particularly helpful to the public utilities, oil industry, U. S. Navy, and especially to the A.S.M.E. Boiler Code Committee in connection with the construction of boilers and pressure vessels. The plates are required to have a minimum tensile strength of 45,000 or 50,000 psi., except aluminum bronze which has an ultimate strength of 90,000 psi. All plates except aluminum bronze, must withstand a cold bend test through 180 deg. around a pin having a diameter equal to twice the thickness of the specimen without cracking on the outside of the bent portion.

The revised Tentative Method of Test for Power Factor and Dielectric Constant of Natural Mica (D 351 – 42 T) was submitted by Committee D-9 on Electrical Insulating Materials. The changes provide for the use of vertical mercury electrodes in addition to or as an alternate to the flat steel electrodes covered by the earlier edition of the method. This revision has been recommended after committee studies which indicated the type of mercury electrode specified in the revised method gives capacitant values comparable with those obtained under higher pressures when using the flat steel electrode.

The new and revised standards have been published in pamphlet form and a copy may be obtained by each member of the Society without charge. Extra copies are available at 25 cents each.

Emergency Standard and Emergency Alternate Provisions Issued

Steel Castings and Pigment Requirements Affected

In extending the procedure for issuing emergency alternate provisions, the Executive Committee anticipated a need for complete Emergency Specifications which would be suitable for use during the National Emergency, or cover permissible alternates for materials that may no longer be available in normal quantities. Developments during A.S.T.M. Committee Week in Cleveland have demonstrated the need for such a provision in the emergency procedure. As mentioned elsewhere in this Bulletin actions were taken in Cleveland looking toward the promulgation of several complete Emergency Specifications in addition to many emergency alternate provisions in existing standards and tentative standards.

The first Emergency Specifications to be issued by the Society cover Lead-Coated and Lead-Alloy Coated Copper Wire for Electrical Purposes. These emergency specifications have been assigned the A.S.T.M. serial designation ES-1 and were prepared by Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors as a result of the contemplated limitations or restrictions on uses of tin for wire coverings. The completion of these specifications is particularly timely in view of the issuance by the WPB of Tin Order M-43-A.

These emergency specifications cover coated hard and soft copper wire and contain provisions for the use of a commercially pure lead or a lead alloy (80 per cent lead min., 20 tin max., 6 antimony max. with 0.5 copper max.) for the coating. The coated hard wire must meet minimum tensile strength requirements of 46,000 to 53,600 psi. depending on the diameter, and the maximum permissible tensile strength of the coated soft grade ranges from 36,000 to 40,000 psi. The specifications include requirements for resistivity of both grades of coated wire and provide also for permissible variations in diameter. Since the continuity of the coating on the wire is important, it is necessary that the material meet a specified immersion test in ammonium persulfate.

Copies of these Emergency Specifications ES-1 are available from A.S.T.M. headquarters and a copy may be obtained by any member of the Society without charge. Extra copies are 25 cents.

Emergency Alternate Provisions

Five additional A.S.T.M. Emergency Alternate Provisions have also been accepted for the Society by Committee E-10 on Standards. All five have been proposed toward increased production of the materials covered. Four of the alternate provisions apply to steel castings and one to an extensively used commercial pigment.

The detailed emergency provisions which have been published in the form of a pink sticker for attachment to the applicable standard specifications follow:

All of the modifications in the steel castings have been studied and developed by the Steel Founders' Society of America and recommended to Committee A-1 on Steel. A number of the provisions suggesting modifications in chemical and physical properties will bring the requirements in line with other specifications, particularly Federal Specification QQ-S-681b and proposed Navy requirements.

The change permitting removal of castings from the furnace charge at 750 F. instead of 500 F. will definitely help production. There is apparently no technical reason in the case of the materials covered why this should not be done. The omission of the manganese requirements from Specifications A 27 would permit a foundry to furnish steel from a low-alloy heat instead of making a special higher carbon steel. The change in physical properties of grade B2 in Specifications A 27 will permit supply from heats of certain classes of Federal and Navy castings. There is no change in the yield point requirement, which is so important in design.

The change in Specifications A 87 concerning weight of casting for which test coupons must be provided brings the requirement in line with other A.S.T.M. specifications and definitely expedites production.

The emergency grade 4, of Class 4, provided for in Specifications A 148 is similar to a widely used class in Federal specifications and should be covered by A.S.T.M.

The more extensive revisions in Specifications A 215 will reduce the number of grades of weldable carbon steel from 8 to 5. These changes will permit the pouring of castings from heats which might also be used for Federal or proposed Navy Specifications. Here again the yield point requirement is changed only to a minor extent. A change in silicon requirement brings this in line with a requirement in a Federal specification which is satisfactory.

The lowering of the minimum limit on PbO from 15 per cent to 11 per cent in Specifications D 82 is expected to result in an increase of about 25 per cent in the production of basic sulfate white lead. This emergency alternate was submitted by Committee D-1 on Paint, Varnish, Lacquer and Related Products.

A copy of the stickers giving these detailed requirements and gummed for affixing in the Book of Standards will be sent in the near future to each member. Meanwhile if a member is very anxious to obtain the stickers, a note to Headquarters will bring them by return mail.

EA - D 82
Issued, March 27, 1942

The following Emergency Alternate Provision, when specified, may be used as an alternate in A.S.T.M. Standard Specifications for Basic Sulfate White Lead (D 82 – 41) and affects only the requirement referred to:

Section 2 (a).—Change the requirement for lead oxide in the dry pigment from:

Lead oxide, per cent.................15.0 to 28.0

to read as follows:

Lead oxide, per cent.................11.0 to 28.0

EA-A 27
Issued, February 24, 1942

The following Emergency Alternate Provisions, when specified, may be used as alternates in A.S.T.M. Standard Specifications for Carbon-Steel Castings for Miscellaneous Industrial Uses (A 27 – 39) and affect only the requirements referred to:

Section 3 (d).—Change the last sentence to read as follows:

No casting so treated shall be removed from the furnace until the pyrometer indicates that the entire furnace charge has fallen to a *temperature of 750 F. (399 C.), or lower, unless otherwise specified by the purchaser.*

Section 5.—Delete the requirement for maximum manganese permitted

Section 8(a).—Add the following as footnote "b" to Table I, applying to grades A-3, B-1, B-2, and H-1:

[b] Unless full annealing is specifically requested in the inquiry, contract, or order, castings made in grades A-3, B-1, B-2, and H-1 may be given a normalize treatment followed by a draw treatment instead of the full anneal treatment.

Table I.—Change the minimum physical requirements for grade B-2 to the following:

	Tensile Strength, min., psi.	Yield Point, min., psi.	Elongation in 2 in., per min., cent	Reduction of Area, per min., cent
Grade B-2.........	65 000	35 000	20	30

EA-A 87
Issued, February 24, 1942

The following Emergency Alternate Provisions, when specified, may be used as alternates in A.S.T.M. Standard Specifications for Carbon-Steel and Alloy-Steel Castings for Railroads (A 87 – 36) and affect only the requirements referred to:

Section 3 (d).—Change the last sentence to read as follows:

No casting so treated shall be removed from the furnace until the pyrometer indicates that the entire furnace charge has fallen to a *temperature of 750 F. (399 C.), or lower, unless otherwise specified by the purchaser.*

Section 9 (a).—Change the first sentence to read as follows:

One or more test coupons sufficient in size and number to provide the required test specimens shall be cast attached near the end of each locomotive frame, to each locomotive cylinder, to each wheel center, and to each other casting, *where practicable, weighing over 500 lb. each*, except as otherwise specially provided for in these specifications.

Also in Section 9 (*a*) change the last sentence to read as follows:

In the case of orders for castings weighing under *500 lb. each*, the physical properties required in Table I shall be determined from an extra or spare test coupon cast attached to another casting from the same melt.

EA-A 148
Issued, February 24, 1942

The following Emergency Alternate Provisions, when specified, may be used as alternates in A.S.T.M. Standard Specifications for Alloy-Steel Castings for Structural Purposes (A 148 – 36) and affect only the requirements referred to:

Section 1.—Change the reference to Class C to read as follows:

Class C.—Castings of *four grades*, which may be liquid quenched and tempered or drawn (Note 3).

Table I.—Add the following minimum physical requirements for a new grade 4 of Class C castings:

	Tensile Strength, min., psi.	Yield Point, min., psi.	Elongation 2 in., in min., per cent	Reduction of Area, min., per cent
Class C, Grade 4....	105 000	85 000	18	40

EA-A 215
Issued, February 24, 1942

The following Emergency Alternate Provisions, when specified, may be used as alternates in A.S.T.M. Standard Specifications for Carbon-Steel Castings Suitable for Fusion Welding for Miscellaneous Industrial Uses (A 215 – 41) and affect only the requirements referred to:

Section 1 (b).—Change to read as follows:

(*b*) *Five grades* are covered, as indicated below, the grade desired to be specified by the purchaser:

Grade EN-1-W not required to be physically tested, nor to be heat-treated except as conditionally provided for in Section 13 (*b*).

Grade EN-2-W not required to be physically tested, but required to be full annealed, normalized, or normalized and drawn.

Grade EA-1-W required to be physically tested, but not required to be heat-treated except as conditionally provided for in Section 13 (*b*).

Grade EA-2-W required to be full annealed, normalized, or normalized and drawn and to be physically tested.

Grade EB-W required to be full annealed, normalized, or normalized and drawn and to be physically tested.

Section 3 (a).—Change to read as follows:

3. (*a*) A heat treatment (Note 3), either by full annealing, normalizing, or normalizing and drawing at the option of the manufacturer, shall be applied to all castings of grades EN-2-W, EA-2-W, and EB-W. Castings of welding quality shall not be cooled from above the critical range by liquid quenching, liquid spraying, or air blasting. Unless otherwise specified, all castings may be annealed one or more times and may be given a supplementary heat treatment by tempering or drawing.

Section 3 (d).—Change the last sentence to read as follows:

No casting so treated shall be removed from the furnace until the pyrometer indicates that the entire furnace charge has fallen to a *temperature of 750 F. (399 C.), or lower, unless otherwise specified by the purchaser.*

Section 5.—Change to read as follows:

5. The steel shall conform to the requirements as to chemical composition prescribed in Table I.

TABLE I.—CHEMICAL REQUIREMENTS.

	Carbon, max.,[a] per cent	Manganese, max.,[a] per cent	Phosphorus, max., per cent	Sulfur, max., per cent	Silicon, max., per cent
Grade EN-1-W...	0.25	0.75	0.05	0.06	0.60
Grade EN-2-W...	0.35	0.60	0.05	0.06	0.60
Grade EA-1-W...	0.25	0.75	0.05	0.06	0.60
Grade EA-2-W...	0.30	0.60	0.05	0.06	0.60
Grade EB-W....	0.35	0.60	0.05	0.06	0.60

[a] For each reduction of 0.01 per cent below the maximum specified carbon content, an increase of 0.04 per cent manganese above the specified maximum will be permitted up to a maximum as follows:

	Manganese, max., per cent
Grades EN-1-W, EA-1-W, EA-2-W...........	1.10
Grades EN-2-W, EB-W.......................	1.00

Table II.—Change to read as follows:

TABLE II.—TENSILE REQUIREMENTS.

	Tensile Strength, min., psi.	Yield Point, min., psi.	Elongation in 2 in., min., per cent	Reduction of Area, min., per cent
Grade EA-1-W, unannealed...	60 000	30 000	22	30
Grade EA-2-W, heat treated...	60 000	30 000	24	35
Grade EB-W, heat treated.....	65 000	35 000	20	30

Typographical Error in Current Specifications

ATTENTION IS directed to an important typographical omission in the A.S.T.M. Tentative Specifications for Aluminum-Base Alloy Sand Castings (B 26 – 41T) as published in the 1941 Supplement to Book of A.S.T.M. Standards, Part I, p. 314. In the fifth column of Table I in the specifications, the value for silicon content of alloy N is printed as "5.0 ± 0" and is intended to be "5.0 ± 0.5." This error resulted when the figure 5 dropped out of the table at the time the specifications were revised in 1941.

Notes on Society Finances

A NUMBER OF INTERESTING points were noted in the Secretary-Treasurer's usual report to the Executive Committee covering 1941 finances. Some of the information, particularly covering receipts and disbursements, is discussed below and the annual report of the Executive Committee as presented at the A.S.T.M.'s annual meeting in June will contain as usual the detailed report of the auditors for the fiscal year, January 1 to December 31, 1941, including balance sheet and full details on investments and related matters.

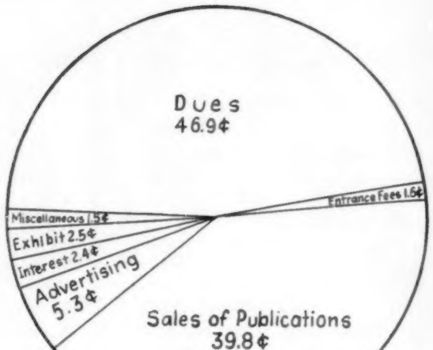
The total operating receipts for 1941 reached a new high—$199,500—of which $96,847 was from dues and entrance fees, $79,434 from sales of publications, and $23,219 from miscellaneous sources including advertising, interest and dividends on investments, exhibit, and miscellaneous sources. The dues receipts were over the budget because of greater net growth in membership and the large increase in sustaining membership. Sales of publications which include sales to members as well as to nonmembers were not quite up to the 1940 figure which was an all-time high, but almost reached it. The very substantial income consistently maintained from sales of publications is a reflection of the demand for the Book of A.S.T.M. Standards and the special compilations and numerous other technical books which the Society issues.

The operating disbursements exceeded the budgeted item somewhat, actual expenditures being $181,500. This figure includes the $6000 earmarked toward partial payment for the 1942 Book of Standards. For the year there was a net favorable balance between receipts and disbursements of $18,000.

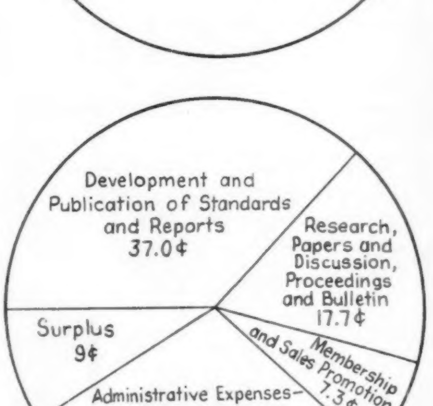
Certain items in disbursements might be noted, including the cost of the 1941 Supplements to the Book of Standards of $17,400—about $2400 over the estimated cost because of the greatly increased size. The Executive Committee added to the gradually growing research fund the amount of $1600[1]—half of the 1941 entrance fees—and slightly under $1500 was used for employees' retirement income. One other item, special work in emergency national defense, totaled $773, representing almost entirely traveling expenses.

One interesting way of presenting graphically the story of 1941 finances is to show the source of the income dollar and how the income dollar was used, as is done in the accompanying diagrams which speak for themselves. These charts, as similar charts and figures in previous years have done, indicate that the services to the members cost considerably more than the income from dues and that they are made possible by income from sales of publications and miscellaneous revenue.

Income Dollar



How Income Dollar Was Used



1942 BUDGET

In the budget for 1942, current receipts are estimated at $185,000, represented by $97,500, dues; $72,000, sales of publications; $15,500, miscellaneous items. Operating disbursements are estimated at $199,000, requiring the application of $14,000 from surplus to balance the budget. A number of costs will be definitely higher, including paper for the extensive publications and printing costs; general office expenses will be increased; the Executive Committee has seen fit to plan for added stenographic help on the staff and to make general salary increases, in part to meet economic conditions, and in part, merit increases. Obviously in times like these, it is difficult to plan finances for a year ahead. Whether the income budget is very conservative and the disbursement liberal, remains to be seen, but it represents the best considered judgment of the Society's Executive Committee.

[1] As of March 20, 1942, the research principal totaled $32,391.15. In addition to the $1600 transferred to the fund in 1941, at its January, 1942, meeting the Executive Committee authorized a transfer of an additional $1600 thus crediting the fund with *all* of the entrance fees received in 1941 and further transferred to the fund an additional $400 as part of the amount to be contributed in 1942.

British Standard Air Raid Precautions Specifications

THERE HAS recently been obtained for the A.S.T.M. Headquarters a complete set of Air Raid Precautions Specifications prepared at the request of the British Ministry of Home Security by the British Standards Institution. Because many A.S.T.M. members either from their personal activities in connection with local community work, or for other reasons, may be interested in knowing what British standards are available, a complete list of ARP specifications is published below. These

specifications are stocked by the Canadian Engineering Standards Association, Room 3010, National Research Building, Ottawa, Canada, and can be obtained from the C.E.S.A. at the prices noted.

AIR RAID PRECAUTIONS SPECIFICATIONS

B.S. ARP No.		Price
1	Heavy Aggregates for Shelters Constructed *in Situ*	15¢
2	Bituminous Paint and Bituminous Compound for the Protection of Steelwork	15¢
3	Electric Hand-lamps	15¢
4	A Fitted Cistern Suitable for Decontamination of Anti-gas Oil-skin Clothing	15¢
5	Chemical Closets for Use in Shelter Accommodation	15¢
6	Shelter Lighting	25¢
7	Electric Lighting of Report and Control Centers	25¢
8	Galvanised Wire Netting and Cloth for Protection Against Flying Particles	15¢
10	Rubber Gaskets for Rendering Doors and Windows Gas Tight	15¢
11	Adhesive Tape for Repairing Gas-proofing Material, Repairing Damaged Material, Sealing Apertures and Cracks, etc	15¢
12	Petroleum Jelly for Sealing Gas-tight Doors, etc	15¢
14	Window Blind Material (Paper)	15¢
15	Light-locks at Entrances to Buildings	25¢
16	Methods of Providing Even Illumination of Low Intensity (0.002 Foot-candle)	25¢
18	Fluorescent and Phosphorescent Paint	50¢
19	Adjustable Hinges	15¢
20	Methods of Providing Even Illumination of Low Intensity (0.02 Foot-candle)	15¢
21	Methods of Providing Even Illumination of Low Intensity (0.2 Foot-candle)	15¢
23	Obscuration Value for Textile Material for Curtains	15¢
26	A Reduced Scheme for the Lighting of Shelters, Where A.C. Mains Are Available	15¢
27	Testing Incombustible Material Resistant to Incendiary Bombs	15¢
30	Gauges for Checking Low Values of Illumination (0.001 to 0.2 Foot-candle)	15¢
31	Ventilation of Buildings in Conditions of Black-out	25¢
32	Illuminated and Non-illuminated ARP Signs	30¢
33	Stirrup Pumps	25¢
	Supplement to No. 33—Drawings	25¢
35	Illuminated Display Cabinets	15¢
36	Headlamp Masks for Motor Vehicles	15¢
37	Street Lighting Under Wartime Conditions	25¢
38	Traffic Paints	25¢
39	Testing Fire-retardant Timber Treatment by Exposure to the Action of an Incendiary Bomb	15¢
40	Bleach Ointment (Anti-gas Ointment No. 1)	15¢
41	Front Lamps for Tram Cars	15¢
43	A Closet for Use in Air Raid Shelters	15¢
47	Testing Incombustible Material to Provide a Minimum Standard of Protection Against Incendiary Bombs	15¢
48	Fabric-bitumen Emulsion Treatment for Roof Glazing	25¢
52	A Simple Portable Standard of Brightness	25¢
53	Detection of Incendiary Bomb Fires by Heat-sensitive Devices	15¢
54	Electrical Heating of Shelters	15¢
55	Detection of Incendiary Bombs by Electrical Circuits Ruptured by Impact	25¢
56	Rot-proofing Canvas, Yarn and Cordage	15¢
57	Rot-proofed Jute, Hessian Sandbags	15¢
58	Rot- and Water-proofing of Jute Canvas	15¢
60	Performance of Photo-electric Devices for Detection of Incendiary Bombs	25¢

C. D. Young Appointed Chief of Procurement and Distribution, U. S. Army, and to Be Brigadier-General

Among the recent appointments resulting from the change in makeup of the Army's general staff which included the appointment of Major-General Brehon Somervell (nominated to be Lieutenant-General), in charge of the Services of Supply, was the appointment of Colonel Charles D. Young as Chief of Procurement and Distribution. But recently appointed Chief of the Materials and Equipment Section, Defense Transportation Office, Colonel Young will now devote his efforts to this important new task. A past-president of the Society (he served during 1921 to 1922), and chairman of Committee A-1 on Steel (1913 to 1918), he has been concerned for many years with problems of materials—procurement and purchasing, including specifications and tests—and his activities with the Pennsylvania Railroad have been in this field. For a number of years he has been Vice-President, in charge of purchases and real estate.

Recent announcement has been made of his nomination for the rank of Brigadier-General.

1942 Heating, Ventilating, Guide

The 47 chapters comprising the twentieth edition of the "Heating, Ventilating, Air Conditioning Guide, 1942" have been considerably revised with a new chapter entitled "Fundamentals of Heat Transfer" covering basic equations for conduction, convection, and radiation. This guide, published annually by the American Society of Heating and Ventilating Engineers follows in style and format previous volumes, but in line with the founders' policy, it is completely reviewed each year and the latest data on the various subjects added.

The Mollier Diagram for Moist Air, which first appeared in the 1941 Guide has been redrawn, and a new Volume Diagram for Moist Air has been included. As the result of intensive research at the A.S.H.V.E. Research Laboratory, the latest information on thermal interchanges taking place between the body and the environment has been included in the chapter on Physiological Principles.

The following chapters have all been revised to include the latest data developed: Central Systems for Comfort Air Conditioning, Air Distribution, Air Duct Design, Sound Control and Fans, Sound Control, Radiant Heating, Pipe and Duct Heat Losses, Terminology, Combustion and Fuels, Automatic Fuel Burning Equipment, Radiators and Convectors, Pipe, Fittings, Welding, Heat Transfer Surface Coils, Spray Equipment, Air Pollution, Air Cleaning Devices, Natural Ventilation, and Water Supply Piping and Water Heating.

This 1200-page publication, in addition to its technical data section, includes a manufacturers' catalogue data section, the roll of membership of the A.S.H.V.E., and complete indexes to the technical and catalogue sections.

Copies of this guide can be obtained at $5 a copy (with thumb index, $5.50) from the American Society of Heating and Ventilating Engineers, 51 Madison Ave., New York, N. Y.

WPB Iron and Steel Branch Advocates Use of 8000 Series Steels

In order to conserve extremely critical and strategic steel alloys, including nickel, chromium, aluminum, manganese, etc., and to take advantage of residual alloys and the benefits of combinations of small percentages of elements as compared with a single alloying element, the Iron and Steel Branch of the WPB is advocating very strongly that all interests which intend to use alloy steels consider immediately the so-called 8000 series of steels which have been recently announced.

TABLE I.—AVAILABLE STEELS.

Number	Carbon, Per Cent	Manganese, Per Cent	Nickel, Per Cent	Chromium, Per Cent	Molybdenum, Per Cent
A 4027	0.25 to 0.30	0.70 to 0.90	....	....	0.20 to 0.30
A 4037	0.35 to 0.40	0.75 to 1.00	....	....	0.20 to 0.30
A 4063	0.60 to 0.67	0.75 to 1.00	....	....	0.20 to 0.30
A 4068	0.64 to 0.72	0.75 to 1.00	....	....	0.20 to 0.30
NF 8024	0.22 to 0.28	1.00 to 1.30	....	....	0.10 to 0.20
NE 8124	0.22 to 0.28	1.30 to 1.60	....	....	0.25 to 0.35
NE 8233	0.30 to 0.36	1.30 to 1.60	....	....	0.10 to 0.20
NE 8245	0.42 to 0.49	1.30 to 1.60	....	....	0.10 to 0.20
NE 8339	0.35 to 0.42	1.30 to 1.60	....	....	0.20 to 0.30
NE 8442	0.38 to 0.45	1.30 to 1.60	....	....	0.30 to 0.40
NE 8447	0.43 to 0.50	1.30 to 1.60	....	....	0.30 to 0.40
NE 8547	0.43 to 0.50	1.30 to 1.60	....	....	0.40 to 0.60
NE 8620	0.18 to 0.23	0.70 to 0.95	0.40 to 0.60	0.40 to 0.60	0.15 to 0.25
NE 8630	0.27 to 0.33	0.70 to 0.95	0.40 to 0.60	0.40 to 0.60	0.15 to 0.25
NE 8724	0.22 to 0.28	0.70 to 0.95	0.40 to 0.60	0.40 to 0.60	0.20 to 0.30
NE 8739	0.35 to 0.42	0.75 to 1.00	0.40 to 0.60	0.40 to 0.60	0.20 to 0.30
NE 8744	0.40 to 0.47	0.75 to 1.00	0.40 to 0.60	0.40 to 0.60	0.20 to 0.30
NE 8749	0.45 to 0.52	0.75 to 1.00	0.40 to 0.60	0.40 to 0.60	0.20 to 0.30
NE 8817	0.15 to 0.20	0.70 to 0.95	0.40 to 0.60	0.40 to 0.60	0.30 to 0.40
NE 8949	0.45 to 0.52	1.00 to 1.30	0.40 to 0.60	0.40 to 0.60	0.30 to 0.40

All of the above steels contain 0.20–0.35 silicon and 0.040 maximum each sulfur and phosphorus.
In addition to the above the usual plain carbon (1000 series), high sulfur (1100 series), high phosphorus (1200 series), silico manganese (9200 series) steels are available in the various carbon ranges, as are, also, certain other carbon molybdenum (4000 series) steels.

These manganese-molybdenum and chromium-nickel molybdenum compositions are given below. They were agreed upon after intensive consideration, and certain experimental work, by leading technical people in the American Iron and Steel Institute, Society of Automotive Engineers, and other interested metallurgists.

John Mitchell, Metallurgical Engineer, Alloy Div., Carnegie-Illinois Steel Corp., was chairman of the committee, cooperating closely with the WPB Iron and Steel Branch.

Naturally all metallurgists are anxious to have as much information as possible about the properties of these 8000 series steels and in this connection a recent American Iron and Steel Institute publication is extremely valuable and timely. The information on hardenability is particularly pertinent. It is listed as Report No. 5 and is entitled "Possible Alternates for Nickel, Chromium and Chromium-Nickel Constructional Alloy Steels." Copies of this report can be obtained from the A.I.S.I., 350 Fifth Ave., New York, N. Y., at 50 cents each.

To develop other needed information as quickly as possible, a subcommittee on Research headed by L. E. Ekholm, Metallurgical Engineer, Alan Wood Steel Co., has been set up in the National Emergency Steel Specifications' Technical Advisory Committee 7 on Carbon and Alloy Bars, Blooms, Billets, and Slabs which functions under A.S.T.M.-S.A.E.-A.I.S.I. auspices. Heats of some of the steels have already been made and others will follow quickly, and since this whole problem is "all-American" in scope it is hoped that those who use the "8000" steels and get information will forward it as promptly as possible to Mr. Ekholm. Among the companies which have poured heats or have them in process are the following: Bethlehem Steel Corp., Carnegie-Illinois Steel Co., Copperweld Steel Co., Pittsburgh Crucible Steel Co., Republic Steel Corp., Rotary Electric Steel Co., Timken Steel and Tube Co., and Youngstown Sheet and Tube Co. Those interested in obtaining steels can apply to their regular steel sources. One of the important problems concerns the weldability of these steels and in this connection research programs are being instituted immediately under

TABLE II.—STEEL COMPOSITIONS.

Standard Series Designation		Possible Alternates		
1942 A.I.S.I. Number	1942 S.A.E. Number	Number	Number	Number
A 1320	1320	A 4027	NE 8024	....
A 1330	1330	A 4037	NE 8233	....
A 1340	1340	A 4047	NE 8245	....
A 2317	2317	A 4027	NE 8024	NE 8620
A 2330	2330	A 4037	NE 8233	NE 8630
A 2335	..	A 4063	NE 8339	NE 8739
A 2340	2340	A 4068	NE 8442	NE 8744
A 2345	2345	A 4068	NE 8447	NE 8749
WD 2350	..	A 4068	NE 8547	NE 8949
A 2515	2515	A 4027	NE 8817	....
A 3045	..	A 4068	NE 8442	NE 8744
A 3120	3120	A 4027	NE 8024	NE 8620
A 3130	3130	A 4037	NE 8233	NE 8630
A 3135	3135	A 4063	NE 8339	NE 8739
A 3140	3140	A 4068	NE 8442	NE 8744
A 3141	3141	A 4068	NE 8447	NE 8749
A 3145	3145	A 4068	NE 8447	NE 8749
A 3150	3150	A 4068	NE 8547	NE 8949
A 3240	3240	A 4068	NE 8442	NE 8744
WD 3250	..	A 4068	NE 8547	NE 8949
A 4119	4119	A 4027	NE 8024	....
A 4130	4130	A 4037	NE 8233	NE 8630
A 4137	4137	A 4063	NE 8339	NE 8739
A 4142	..	A 4063	NE 8442	NE 8744
A 4145	4145	A 4068	NE 8447	NE 8749
A 4150	4150	A 4068	NE 8547	NE 8949
A 4320	4320	..	NE 8124	NE 8724
A 4340	4340	A 4068	NE 8547	NE 8949
A 4620	4620	A 4027	NE 8024	NE 8620
A 4640	4640	A 4063	NE 8339	NE 8739
A 4645	..	A 4068	NE 8447	NE 8744
4650	..	A 4068	NE 8547	NE 8949
A 4820	4820	..	NE 8124	NE 8724
A 5045	..	A 4063	NE 8339	....
A 5120	5120	A 4027	NE 8024	....
A 5130	..	A 4037	NE 8233	....
A 5140	5140	A 4063	NE 8339	....
A 5145	..	A 4068	NE 8442	....
A 5150	5150	A 4068	NE 8447	....
A 6120	..	A 4027	NE 8024	NE 8620
..	6130	A 4037	NE 8233	NE 8630
WD 6140	..	A 4063	NE 8339	NE 8739
A 6145	..	A 4068	NE 8442	NE 8744
A 6150	6150	A 4068	NE 8447	NE 8749

the auspices of the Welding Research Committee to obtain weldability data on certain of the compositions considered suitable for welding. At a recent meeting there was discussion of various tests and it was agreed to carry out a number of T-bend tests and bead tests.

A recent news release from the WPB in addition to listing the chemistries of the steel and urging prompt consideration of their merits also gave a table showing existing A.I.S.I.-S.A.E. chemistries and what may be considered alternate steels in the 8000 series.

However, a definite word of caution should be given in this respect because each application undoubtedly must be considered on its own merits. It is a fact that certain properties of some of the "8000" steels are better than the regular series for which they are suggested as alternate.

The WPB release indicates that "these steels and certain others containing less strategic elements, or none, will soon be the only steels available. It is therefore imperative, it was explained, that industry take the necessary steps to change over as quickly as possible so as to be prepared when the supply of habitually used steels is cut off."

It was further indicated that "in the early stages of this program it may not be possible for a user to obtain the exact bar size or shape to which he is accustomed and it may be necessary to accept some other size and possibly even a forged bar in order to carry out a test program."

This work is a splendid example of prompt and efficient results which can be obtained when leading technologists knuckle down to do a specific job.

Materials Substitutions

THE CONSERVATION and Substitution Branch of the War Production Board's Bureau of Industrial Conservation has issued as of February 23, 1942, provisional lists of materials arranged in three groups according to their availability for use in civilian industry. Since this will undoubtedly be of interest to many members, it is reprinted here. In reviewing the list it should be kept definitely in mind that *it is of a tentative nature and is subject to change*, in some cases perhaps rather rapid change. This B.I.C. branch plans, as indicated, to bring the report up to date and reissue it periodically.

WAR PRODUCTION BOARD
BUREAU OF INDUSTRIAL CONSERVATION
CONSERVATION AND SUBSTITUTION BRANCH
Washington, D. C.
February 23, 1942

MATERIALS SUBSTITUTIONS

Issue No. 1

The first group comprises materials that are critically essential for the prosecution of the war and the use of which is subject to allocation by the War Production Board for direct war purposes or for essential civilian needs. For these materials the civilian industry must largely find substitutions or anticipate stoppage of manufacture of articles containing them.

The second group comprises materials also necessary for the war and essential industrial activity but of which only part is now required for the more urgent applications. Necessary civilian activities can obtain limited allocations from this group to replace unavailable materials if the cases are sufficiently urgent.

The third group comprises materials that are most available for substitutions, although in no case can the supply be considered unlimited, since other factors than the material itself may determine the amount available.

Since the status of those and other materials with respect to supply and demand is constantly changing, it is planned to reissue this report periodically to reflect changing conditions.

Group I.—Materials That Are Entirely Allocated for War and Essential Industrial Purposes.

Material	Order Numbers[a]	Date of Issue
	METALS	
Alloy Steel Iron Alloy Alloy Steel Wrought Iron	M-21-a, b, d, e, with amendments and extension	1941: 8-9; 10-14; 11; 25; 12-1; 9-16-12-20; 9-3; 12-24; 12-27 1942: 2-3
Aluminum	M-1, M-1-a, b, c, e, f, with extensions	1941: 3-22; 3-22; 4-11; 5-20; 6-10 1942: 1-23; 2-20
Aluminum Scrap	M-1-d	1942: 1-7
Cadmium	M-65, M-65-a	1942: 1-17
Calcium-silicon	M-20, M-20-a with amendment	1941: 7-29; 11-29; 12-20
Chromium	M-18, M-18-a with amendments	1941: 7-7; 8-22; 11-29 1942: 1-13; 2-6
Cobalt	M-39, M-39-a, b with amendment	1941: 11-4; 12-5 1942: 2-6; 2-6
Copper	M-9-a, c, with four amendments and interpretation	1941: 8-2; 10-21; 11-1; 12-10 1942: 1-13; 2-6; 2-6; 2-19
Copper scrap	M-9-b	1941: 12-31
Iridium	M-49	1941: 12-12
Lead	M-38, M-38-a, b, c, d, e	1941: 10-4; 10-18; 12-1; 12-31 1942: 1-10; 2-9
Magnesium	M-2, M-2-a, b, extension	1941: 3-24; 3-24; 4-2; 11-14
Nickel	M-6-a, M-6-b	1941: 9-20; 11-10
Tin	M-43, M-43-a with amendments	1941: 12-17; 12-31 1942: 1-14; 2-18
Tinplate and Terneplate	M-81	1942: 2-13
Tungsten	M-29; M-29-a, b	1941: 8-31; 10-13 1942: 2-18
Tungsten (High Speed Tools)	M-14 with amendments	1941: 6-11; 11-29; 12-31
Vanadium	M-23, M-23-a	1941: 8-14; 12-20
	CHEMICALS	
Alcohol Ethyl Methyl	 M-30 with amendments M-31 with amendments	1941: 8-28; 11-29; 12-31 1942: 1-22 1941: 8-28; 11-12; 12-19; 12-31
Chlorinated Hydrocarbon Refrigerants	M-28 with amendments	1941: 8-22; 12-31
Chlorinated Hydrocarbon Solvents	M-41	1941: 10-15-41
Chlorine	M-19 with amendment	1941: 7-26; 12-20
Diphenylamine	M-75	1942: 1-30
Formaldehyde Paraformaldehyde Hexamethylenetetramine and Synthetic Resins therefrom	M-25 with amendments	1941: 8-23; 8-28; 10-1; 11-17; 11-17; 12-31
Phenols	M-27, M-27 as amended	1941: 8-30; 11-10
Polyvinyl Chloride	M-10 and amendment	1941: 6-9; 12-31
Sodium Nitrate	M-62	1942: 1-15
Toluene	M-34 and amendment	1941: 8-28 1942: 1-12

MISCELLANEOUS PRODUCTS

Item	Order Numbers	Date of Issue
Agar	M-96	1942: 2-9
Asbestos (Long Fiber)	M-79	1942: 1-20
Burlap and Burlap Products	M-74 (and amendments)	1941: 12-22 1942: 2-18
Cashew Nut Shell Oil	M-66	1942: 1-13
Cotton Linters	M-12 (as amended)	1941: 11-5
Graphite (Madagascar)	M-61	1942: 2-20
Hemp Seed	M-82	1942: 1-23
Jewel Bearings	M-50	1942: 1-14
Kapok	M-85	1942: 2-6
Manila Fiber and Cordage	M-36 (and amendments)	1941: 8-29; 10-13; 12-9
Pig and Hog Bristles	M-51, 51-a (and amendments)	1941 12-13 1942: 1-7; 1-30; 2-4
Rubber, Crude, and Latex	M-15; M-15-b; M-15b1; M-15c (and amendments)	1941: 6-20; 8-4; 8-8; 11-12; 12-11; 12-19; 12-27; 12-27 1942: 1-2; 1-3; 2-1; 2-9; 2-20
Chlorinated	M-46 (amendment)	1942: 2-23
Synthetic	M-13 (and amendments)	1941: 6-9; 12-31
Shearlings	M-94	1942: 2-16
Silk	M-22 (amendments and interpretations)	1941: 7-26; 8-2; 8-12; 8-26; 10-16; 10-28 1942: 2-9
Silk Waste Silk Noils Carnetted and Reclaimed Silk Fiber	M-26 (and amendments)	1941: 8-8; 9-5 1942: 2-2

[a] "M" orders create industry-wide controls over materials. The list is intended to give information as to the most important critical materials and possible substitutions and is not to be construed as an official listing of all "M" orders.

Sperm Oil	M-46	1941: 10-16
Tin Cans	M-81	1942: 2-12
Titanium Pigments	M-44 (and amendments)	1941: 11-21; 1942: 1-7; 2-1
Tung Oil	M-57 (and amendments)	1941: 6-9; 12-31

Group II.—Basic Materials That Are Essential to the War Industries but Whose Supply Is Not So Critically Limited As Materials of Group I.

Acetone	Flax	Platinum
Ammonia (anhydrous)	Fish Liver Oils	Potassium Perchlorate Permanganate
Antimony	Glycerine	Quartz Crystals
Arsenic	Hides and Leather	Quinine
Barium Carbonate	Hog Bristles	Rape Seed Oil
Beryllium-Copper Alloys	Iodine	Rayon
Borax	Jute	Rubber (Reclaimed)
Calcium	Linseed Oil	Sisal
Carbon Tetrachloride	Manganese	Steel, Carbon Scrap
Camphor	Mercury	Spirits, Distilled
Citric Acid	Mica Splittings	Sugar
Cocoanut Oil	Molybdenum	Tanning Materials
Cork	Natural Gas	Vitamin "A" Products
Corundum	Natural Resins	Wool
Cotton Duck	Nylon	Zinc (all grades)
Cryolite	Palm Oil	
Diamond (Industrial)	Phosphorus	
	Phthalates	

Group III.—Materials Available in Significant Quantities for Other than Strictly War Purposes. However, as in the Case of Glass, the Use May Be Restricted by Accompanying Manufacturing Limitations. Restrictions Are Commonly Imposed but Supplies Are Not Critically Short, Except in the Case of Iron and Steel.

PREFERRED SUBSTITUTE MATERIALS

Asbestos (Common)	Glass	Silver
Asphalt	Gold	Slate
Brick and Tile	Lignin	Sulfur
Cement	Limestone and Marble	Wall Boards
Ceramics	Lumber and Millwork	Wood and Products
Clay	Mineral Wool	Wood Flour
Coal and Coke	Paper	Wood Fibers
Concrete	Paperboard	Wood Pulp
Cotton	Plywood	
Feldspar	Salt	

MATERIALS AVAILABLE IN VARYING AMOUNTS FOR SUBSTITUTIONS

Ammonia (aqueous)	Gasoline	Silicon and Alloys
Bismuth	Lubricating Oil	Sodium Nitrate (Chile)
Cellophane	Paraffin	Soy Beans and Products
Cottonseed Oil	Plastics (cellulose, acetate, butyrate)	Protein
Gypsum and Products	Rhodium	Oil
Hair (cow, horse)	Rosin	Turpentine
Petroleum Products Crude Oil		

WAR MATERIALS PRESENTLY AVAILABLE FOR SUBSTITUTIONS IN CRITICAL CIVILIAN INDUSTRY

Basic Low-Carbon Steel	Bessemer Steel	Gray Cast Iron
	Pig Iron (M-17; 1941; 8-1)	Malleable Iron

A.F.A. Convention and Foundry Show to Be Held in Cleveland, April 20 to 24

The 1942 Foundry and Allied Industries Show and First Western Hemisphere Foundry Congress will be held in conjunction with the 46th Annual Convention of the American Foundrymen's Association, in the Public Auditorium, Cleveland, Ohio, during the week of April 20 to 24. The program for the meeting is a strong and most timely one with all authors stressing war production. The Foundry Congress will be more like a university short course with each man in attendance matriculating in subjects of vital interest to him, the instruction staff consisting of authors of papers and discussion leaders, men who come to give freely of their knowledge and experience. The exhibit halls will comprise the shops and laboratories, staffed with exhibitor representatives able and willing to give advice and instruction on the latest in plant production practice. The schedule of exhibit hours is as follows: Monday, April 20, 9 a.m. to 10 p.m.; Tuesday, April 21, 9 a.m. to 5:30 p.m.; Wednesday, April 22, 9 a.m. to 5:30 p.m.; Thursday, April 23, 9 a.m. to 5:30 p.m.; Friday, April 24, 9 a.m. to 3:30 p.m.

Industrial Inspection Firms Rated A-10 for Supplies

Firms engaged in examining or inspecting industrial installations for the purpose of discovering faults or defects are authorized to use an A-10 preference rating to obtain operating supplies by WPB Amendment No. 1 to Preference Rating Order P-100. The amendment was issued February 28 by the Director of Industry Operations.

The functions of companies engaged in the inspection of boilers and other plant equipment are closely related to maintenance and repair, and the amendment gives such firms the benefit of the same priority rating which might be used by the companies for which they perform inspections. Their chief need is for certain small precision tools used in such work, a statement indicates.

Calendar of Society Meetings

(Arranged in Chronological Order)

American Society of Mechanical Engineers—Spring Meeting, March 23–25, Houston, Tex.; Semi-Annual Meeting, June 8–11, Cleveland, Ohio.

Electrochemical Society—Spring Convention, April 15–18, The Hermitage Hotel, Nashville, Tenn.

American Society of Civil Engineers—Spring Meeting, April 19–23, Hotel Roanoke, Roanoke, Va.

American Ceramic Society—Forty-fourth Annual Meeting, April 19–25, Netherland Plaza Hotel, Cincinnati, Ohio.

American Foundrymen's Association—Forty-sixth Annual Convention and the Foundry and Allied Industries Show, April 20–24, Cleveland Public Auditorium, Cleveland, Ohio.

American Chemical Society—Spring Meeting, April 20–23, Memphis, Tenn.

American Mining Congress—Annual Coal Convention and Exposition, April 27–May 1, Music Hall, Cincinnati, Ohio.

National Electrical Manufacturers Association—Spring Conference, May 10–15, Hot Springs, Va.

American Institute of Chemical Engineers—34th Semi-Annual Meeting, May 11–13, Boston, Mass.

American Petroleum Institute—Twelfth Mid-Year Meeting, May 25–28, Oklahoma-Biltmore Hotel, Oklahoma City, Okla.

American Iron and Steel Institute—General Meeting, May 28, New York, N. Y.

Society of Automotive Engineers—Semi-Annual Meeting, May 31–June 5, The Greenbrier, White Sulphur Springs, West Va.

American Electroplaters' Society—Thirtieth Annual Convention, June 8–11, Pantlind Hotel, Grand Rapids, Mich.

American Water Works Association—Annual Convention, June 21–25, The Stevens Hotel, Chicago, Ill.

American Institute of Electrical Engineers—Summer Convention, June 22–26, Chicago, Ill.

American Society for Testing Materials—Forty-fifth Annual Meeting, June 22–26, Chalfonte-Haddon Hall, Atlantic City, N. J.

Committee Week;

Important Actions on Standards

(*Continued from page 10*)

chemistries. Some revisions are being set up of an emergency alternate nature for early publication.

To cooperate with the Boiler Code Committee so that the material can be specified for use in fabricating pipe, chemistry changes are being set up in the material for corrosion resisting chromium-nickel plate for fusion welded unfired pressure vessels. Of particular significance in certain fields, primarily in the pressure vessel field, is the decision to expand a committee charged with drafting specifications for clad plate and to expedite this work.

Copper Wires for Electrical Conductors

The outstanding action taken by Committee B-1 on Copper and Copper-Alloy Wires for Electrical Conductors concerned agreement on specifications for lead and lead-alloy copper-coated wires but a number of other important decisions were reached. The first of these concerns Spec. for Soft Rectangular and Square Copper Wire for Electrical Conductors (B 48 – 40 T). Detailed sketches defining shapes of edges are to be sent to the membership of the committee for study and comment. As soon as agreement is reached, the specifications, now tentative, will be acted on for adoption as standard.

It was agreed to circulate for study a new torsion test proposed in Spec. for Hot-Rolled Copper Rods for Electrical Purposes (B 49), which sets up a test procedure for revealing rolling defects such as fins, over-fills, seams, flakes, etc.

An enlarged subcommittee was appointed to complete the Specifications for Rope-Lay-Stranded and Bunch-Stranded Copper Cables for Electrical Conductors (B 158 – 41 T), and it was also agreed to divide these specifications into the three following separate standards: rope-lay-stranded copper cables having concentric-lay-stranded members; rope-lay-stranded copper cables having bunch-lay-stranded members; bunch-stranded conductors.

As indicated final agreement was reached on changes in the preliminary draft of the proposed specifications for lead and lead-alloy coated copper wires for electrical conductors, and it was agreed to submit the specifications with these changes for acceptance as an emergency standard. By this procedure it will be immediately available to the industry. While the standard exists as an emergency item further work will be put on it so that it can be submitted to the Society for normal action, as a new tentative standard. In acting through the emergency alternate procedure, the specifications should be available in a few weeks but because the use of this type material will probably be longer than the emergency period, the committee believes it desirable, as indicated, to have the Society approve them as regular specifications at its June meeting.

After discussing the proposed American Standard B32, Preferred Sizes for Bare and Metallic Coated Round Wire, which had been developed in a Sectional Committee under the auspices of the American Standards Association, it was agreed to recommend that this standard *not* apply to the round wires covered in the specifications developed by Committee B-1.

Standards and Research on Electrical Alloys

New York Meeting of Committee B-4

As THE RESULT of actions taken at the meeting of Committee B-4 on Electrical-Heating, Electrical-Resistance, and Electric-Furnace Alloys at the Hotel New Yorker, New York City, February 12 and 13, the committee expects to make a number of recommendations on standards to the Society and to continue an active research program.

Recommendations on Standards

Recommendations on standards are expected to include the following:

New Specifications for Cast Alloys for High-Temperature Service (approximately 25 per cent Chromium, 12 per cent Nickel). These would cover material suitable for use in electric furnaces. Other suitable alloys are being considered, including the following compositions: 35 per cent nickel, 15 per cent chromium, balance iron; and 60 per cent nickel, 12 per cent chromium, balance iron.

Method of Test to Determine the Density of Fine Wire Used in Electronic Tube Applications. Two members of the committee have offered to run check tests using this proposed method and a sample will also be sent to the National Bureau of Standards with a request that a check test be made.

Specifications for Round Nickel Wire for Lamps and Electronic Devices.

Method of Test for the Effect of Furnace Atmosphere on Electrical Heating Materials.

Adoption as Standard of:

Tentative Methods of Testing Sleeves and Tubing for Radio Tube Cathodes (B 128 – 40 T).

Revision and Continuance as Tentative of:

Tentative Methods of Testing Nickel and Nickel-Alloy Wire and Ribbon for Electronic Tube Filaments (B 118 – 39 T).

Tentative Methods of Testing Lateral Wire for Grids of Electronic Devices (B 156 – 41 T).

Research Projects

Subcommittee I on Life Tests reports that interlaboratory life tests on heater wires, now being conducted by four laboratories, are being continued. The National Bureau of Standards has set up a life-test board and is preparing to make tests and to check on a standard sample furnished by the subcommittee.

The section on life tests of Subcommittee X on Contact Metals reports that an investigation is being carried out on contact metals with the significance of various factors being studied in the following order: sticking or welding, temperature increase, change in weight, change in dimen-

sions, and voltage drop across the contacts. A technical report on "Surge Tests in the Life Testing of Contacts" is being prepared.

Subcommittee X's section on standardization of contact forms and sizes is preparing a list of standard sizes for solid contact rivets. It is hoped, after this standard has been completed, to prepare similar standards for contact buttons, screws, and other commercially used forms of contact metal.

Die-Cast Metals and Alloys

Through its intensive research and standardization activities Committee B-6 on Die-Cast Metals and Alloys has done a great deal to further a better understanding of the effective properties of die castings and its work over many years has stimulated the use of these materials both industrially and in domestic applications. Recently, proposed Emergency Alternate Provisions in the zinc-base die casting specifications (B 86 – 41 T) have been submitted to letter ballot. As a result of discussion at a meeting in Cleveland held by Subcommittee I on Aluminum-Base Alloys some important modifications are being proposed in the Specifications B 85 covering aluminum-base material. It was agreed that some modification was desirable in Alloy VII, a 4 per cent copper, 5 per cent silicon, 91 per cent aluminum composition. A new modification termed "Alloy VIIa" of relatively high iron content will be set up for manufacture by goose-neck type die casting machines. This is to be carried through the A.S.T.M. as a regular revision and it is expected will be incorporated in the specifications this year to replace Alloy VII. At the same time an alternate or temporary composition is to be provided termed "Alloy VIIb" in line with certain Government specifications (this will be expedited by issuing as an Emergency Alternate Provision). This alloy has a lower iron content and is suitable for casting by the cold-process die casting machine.

In view of the excellent toughness properties reported for the low-iron alloy composition, Committee B-6 is arranging for a research program to determine authoritatively important properties of the alloy. Alloys of various low-iron contents will be studied to determine the effects of reducing iron content by using virgin aluminum rather than secondary metal. Because of the extreme importance of composition and properties in the use of alloys, the committee has always based its recommendations on series of tests which have covered such matters as castability, corrosion resistance, and physical properties, and that is essentially the reason for this study of the low-iron content alloys. At the same time by establishing as an Emergency Alternate Provision requirements for new Alloy VIIb, no time is being lost. The ultimate aim in this work is to be able to insure die casting the materials to accurate shape with superior properties that are not obtained from parts fabricated by machining from wrought bars.

Thermometers

The Committee on Thermometers decided to recommend for adoption as standard a change in the A.S.T.M. high-distillation thermometer E 1 (8 C – 39) and E 1 (8 F – 39). The revision will change the distance from the bottom of the bulb to the graduation line. If accepted by the Society the change will become effective on December 1, 1942.

A change in the open-flash thermometer E 1 (11 C – 39) and E 1 (11 F – 39) will reduce the length of the bulb. This would become effective as of December 1, 1942.

The committee recommended the adoption of the A.S.T.M. turpentine distillation thermometer and the titer test thermometer for use in the analysis of soaps.

Hardness Conversion Tables

The National Emergency has emphasized the need and importance of recognized and authoritative tables or charts for the conversion of hardness test data for metals. Such conversion tables would be especially useful, particularly for the hardness methods that are widely used in this country such as the Brinell and Rockwell tests and also for the diamond pyramid hardness (Vickers) which is now used here and which has had extensive application in England. While considerable data on the subject is available, there are variations in the conversion values so that it is not always possible to obtain comparable results. The Section on Indentation Hardness (J. R. Townsend, Chairman), of Committee E-1 on Methods of Testing which has been at work on this matter for the past year, has recognized in undertaking its test program that no single hardness relation exists for all metallic materials, and that it may accordingly be necessary to develop or obtain a conversion table for each commonly used alloy.

The extensive use of cartridge brass in connection with the war effort and the urgent need for hardness conversion data for this alloy led the section to undertake a cooperative series of round-robin tests to obtain authoritative information. The results have been carefully studied by the committee and as a result action was taken at its Cleveland meeting to submit to the Society for immediate publication a proposed hardness conversion table for cartridge brass (70 per cent copper, 30 per cent zinc) alloy. This table will cover conversion values for the range of diamond pyramid hardness numbers from 145 to 196, with equivalent Brinell hardness numbers, and also Rockwell hardness numbers for both the *B* and *F* scales and for the superficial Rockwell hardness scales 15T, 30T, and 45T. In addition, there is included a supplementary table showing the average deviation of results of hardness conversions for this material.

The studies are now being extended to determine the hardness conversion relationships for the hardened steels. A special subcommittee to proceed with this work was appointed under the chairmanship of R. L. Kenyon. At the meeting there was presented a paper on "Hardness Conversion Relationships" by R. H. Heyer, American Rolling Mill Co., which discussed three factors contributing to the uncertainty of present hardness conversion relationships; namely, (1) differences in work-hardening capacities of the materials tested, (2) differences in the contours of the hardness impressions as made in various materials, and (3) high rates of flow of some materials under load in the hardness test.

This work on hardness conversion is being carried on in cooperation with the Society of Automotive Engineers and the American Society for Metals.

Tension Testing of Metals

The Section on Tension Testing (R. L. Templin, Chairman) of Committee E-1 reviewed the Tentative Methods of Tension Testing of Metallic Materials (E 8 – 40 T) and decided to make one important change involving the testing of sheet metals. As now published the method provides for testing ferrous and non-ferrous metals in the form of plate, sheet, flat wire, strip, band, and hoop down to a nominal thickness of 0.01 in. Since the methods have also been found suitable for testing thinner materials, it was decided to change this lower limit of thickness to read 0.005 in. In addition, several editorial changes will clarify the descriptions of the test specimens and the procedure for determining yield point. With these modifications, the methods will be recommended for adoption as standard.

Chemical Analysis of Aluminum and Magnesium

Committee E-3 on Chemical Analysis of Metals through its subcommittee on aluminum and magnesium and their alloys has been actively studying procedures for the analysis of aluminum and aluminum alloys and magnesium and magnesium alloys. Final agreement on a complete set of standard methods was reached at a meeting in Cleveland.

The methods for the analysis of aluminum alloys are in effect an extensive revision and expansion of the present A.S.T.M. Tentative Methods (B 40 – 36 T.) In drafting these methods considerations were given to procedures published by the Bureau International de L'Aluminum, British Aluminum Co., The Aluminum Research Institute, and the Aluminum Company of America; also suggestions from a number of committee members and others who have had experience with such analytical tests. The standard methods will cover determinations for numerous elements including the following: silicon; iron; titanium; copper, lead, and bismuth; zinc; manganese; magnesium and calcium; chromium; nickel and tin.

The procedures for chemical analysis of magnesium and magnesium alloys will represent a new and important addition to the widely used A.S.T.M. methods. In the development of these methods the committee considered analytical procedures used by the Dow Chemical Co., methods used by the Aluminum Company of America, and the experience of a number of members of the committee and other collaborators who participated in an analysis of magnesium samples in arriving at alternate and optional methods. These methods cover determinations for: aluminum, zinc, manganese, copper, silicon, iron, nickel, tin, and cadmium.

Metallography

Committee E-4 on Metallography announced that as a result of intensive study a recommended practice for X-ray diffraction (powder analysis) should be completed in time for submission to the committee at its June meeting for publication in the 1942 Book of A.S.T.M. Standards. The Society has recently published a 4000-card index, giving important information used in X-ray diffraction analysis and the proposed method ties in with the use of this card file.

Another important matter concerns procedures for non-metallic inclusions in steel. It is possible that the test will cover the magnaflux methods as a macroscopic test and microscopic details may be based on methods proposed by the Society of Automotive Engineers and the S.K.F. procedures. Considerable work has been carried out by Committee E-4 in studying the various procedures proposed. A number of editorial changes and additions are to be made in the Methods of Preparation of Metallographic Specimens (E 3 – 39 T). Newer methods are to be added covering non-ferrous metals, including aluminum, magnesium, and zinc coatings on steel. Revisions will cover electrolytic polishing methods, which may be published as information and for comment as an appendix to the 1942 report of the committee.

Consideration of changes in the Methods of Preparation of Micrographs of Metals and Alloys (E 2 – 39 T) will depend on another action with respect to non-ferrous grain size standards. The method will be continued as tentative, but new material will be added covering low power photography (up to 10X). This will include some improvements and elaboration with schematic diagrams on better methods of illustrating specimens.

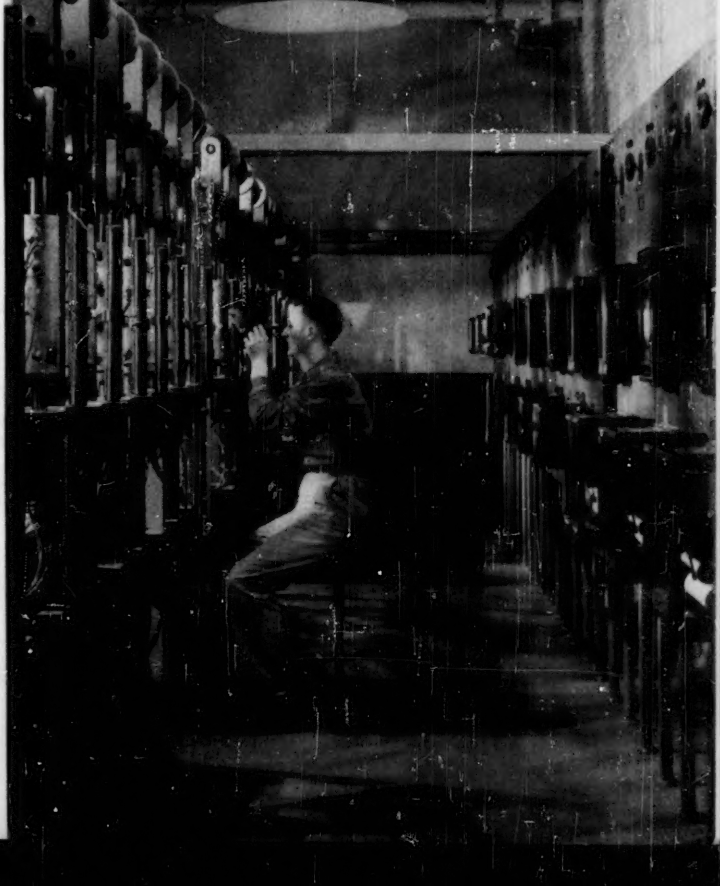
In the field of dilatometric analysis a draft of a recommended practice has been prepared and will be studied further before special action is taken.

Refractories

Late in 1940, Committee C-8 on Refractories set up changes in the details of carrying out the panel test for various refractory materials—the three standards covering resistance to thermal and structural spalling of refractory

"'Creep' Laboratory"

Honorable Mention, Nonprofessional, in the Fourth A.S.T.M. Photographic Exhibit, by E. R. Seabloom, Crane Co.



brick (C 38), high-heat duty fireclay brick (C 107), and super duty fireclay brick (C 122). At its Cleveland meeting these changes were proposed for adoption as standard. Also adopted will be existing tentative changes in the test for pyrometric cone equivalent (C 24).

The Society has issued tentative definitions of six terms relating to refractories: Abrasion, Burning (Firing), Calcining, Corrosion, Erosion, and Slagging. Committee C-8 is proposing that these definitions be formally adopted, but the one on calcining has been referred back to the subcommittee for consideration and some editorial changes.

The committee anticipates there will be a new standard covering plastic fireclay completed for submission to the Society in June, and it was announced that the subcommittee on heat transfer expects to have a proposed method for determining thermal conductivity at high temperatures which can be referred to Committee C-8 for consideration at its next meeting. This subject has been under study for almost ten years in the various laboratories and has been investigated by numerous authorities in the field; many problems in the development of the special apparatus needed had to be solved. Further work will be carried out at the National Bureau of Standards with which Committee C-8 has been cooperating closely, so that further refinements may be perfected in the apparatus and method.

It was announced that an industrial survey was being prepared on refractories used in electric furnaces in the steel industry. These industrial surveys which have been published by the Society in the Manual of A.S.T.M. Standards on Refractory Materials have provided critical discussion of properties, tests, and service conditions of refractories and are considered to be of widespread service to those concerned with the fields covered.

Concrete and Concrete Aggregates

In addition to a review of the status of its Symposium on Significance of Tests of Concrete and Concrete Aggregates, a revision of which is being issued, Committee C-9 on Concrete and Concrete Aggregates acted on a number of important standards and approved for transmission to letter ballot certain new standards.

The symposium essentially is to bring up to date the publication issued several years ago which contained very valuable and authoritative information on the subjects covered. Twenty of the authors of reports given in the symposium have virtually completed their work and the material is to be referred to the entire committee for approval. Five other reports are nearly completed and these will be balloted on before final acceptance. The resulting publication should be of great value.

As in many fields of materials, standard definitions are extremely important and new ones covering water–cement ratio, flat piece and elongated piece (aggregates) and a revised definition of blast-furnace slag will be issued.

A proposed standard for determining air content in fresh concrete will be recommended to the Society. This is particularly important because of rapid developments in the use of grinding aids which introduce or entrain air in concrete.

Another new test will cover procedures for measuring the length of concrete cores drilled from structures. There has been a great deal of work done in this field. The committee has studied methods used by some of the state highway departments and the Public Roads Administration has cooperated extensively. It is planned to publish in the annual report of the committee a discussion and information developed by the Public Roads Administration which is the basis for the new procedures.

Another new specification will cover waterproofed paper for use in the curing of concrete. This is to be referred to the Society's standing Committee on Paper and Paper Products but action is proceeding in Committee C-9 so that the standard can be approved in June.

Several other matters were discussed at the meeting including a proposed method for determining surface moisture in fine aggregate. Drafts of this are to be studied further. Another matter under study is the proposal that in making sieve analysis of fine aggregate limits be set up for the amount of material imposed on any one sieve—in other words, to avoid overloading a particular sieve.

Another of the committee's widely used specifications covering ready mixed concrete (C 94 – 41 T) is to be revised with the section on description of terms clarified, covering ready-mixed, central-mixed, shrink-mixed, and transit-mixed concretes, and other clarifying changes. One of the changes in the section on physical strength involves a footnote stating that it is desirable for at least 90 per cent of all strength tests to be equal to or greater than 90 per cent of the specified strength. It is stated that this requirement is impractically rigid unless a considerable number of specimens is involved. Based on work under way the committee hopes by June to propose further revisions dealing with this broad and important question of the number of tests necessary and desirable to evaluate properly the quality of the material and also the concordance of the test.

A number of standards are to be revised, some editorially, in the interest of clarification. In the Test for Unit Weight of Aggregate (C 29 – 39) there will be incorporated more exact specifications on the weight of the cylindrical metal measure used. Some of these have been made unnecessarily heavy. Minor changes will also be set up for immediate adoption in the Methods of Making and Storing Compression Test Specimens (C 31) and Test for Compressive Strength of Concrete (C 39), and changes to be adopted at the annual meeting will be offered in the Method of Test for Cement Content of Hardened Portland-Cement Concrete (C 85).

In addition to editorial changes in the Standard Specifications for Concrete Aggregates (C 33 – 40) references will be incorporated to the Los Angeles abrasion test but most important are grading changes which are being incorporated covering fine aggregate requiring more material finer than 50 and 100 sieve size, especially when used for leaner mixes.

Gypsum

In its work on testing methods Committee C-11 on Gypsum is investigating different procedures that have been proposed for determining particle size of gypsum products in the range of 40 microns and smaller; the committee will cooperate with a number of other groups, particularly Committee C-1 on Cement and also with the Technical Committee on Particle Size.

The standard specifications for calcined gypsum for den-

tal plasters (C 72) which cover three grades—quick, medium, and slow setting—provide requirements for time of setting, tensile strength, and fineness, and the committee now proposes that there be included requirements for compressive strength. These values will be set up as tentative revisions and published for comment.

As a result of detailed consideration of existing standards covering gypsum wall board (C 36), gypsum lath (C 37), and gypsum sheathing board (C 79), changes are being proposed. The lath specifications cover material of three thicknesses—$^1/_4$ in., $^3/_8$ in., and $^1/_2$ in.—and now requirements for $^5/_{16}$-in. thick lath will be established. The requirements in this standard cover flexural strength, weight, and related matters.

Since wall board is available in various edges, that is, V, tongue, and groove edge, as well as square edge, revisions will be incorporated to cover recessed edge material. Requirements on size and variations are to cover a 24-in. width board, in addition to the 32, 36, and 48 in. now covered, and also, an increase in normal length will provide that instead of the present 4 to 12 ft., inclusive, it shall be 4 to 14 ft., inclusive. The sheathing board specifications will omit all reference to $^3/_4$-in. thick board and also to the 32-in. width material.

Based on considerable work a proposed test method for determining purity of gypsum and calcined gypsum by the ammonium acetate method was published in the 1940 *Proceedings*. The committee now is proposing that there be included immediately in the standard test methods this procedure as an alternate to the present gravimetric methods. The alternate method will cover determining calcium sulfate by extraction with ammonium acetate solution.

Another project in the test field is to cover procedures for determining water permeability of gypsum sheathing board.

A revised definition of perforated gypsum lath is being offered for adoption as standard. This is as follows:

Perforated Gypsum Lath.—A gypsum lath with perforations. For one hour fire-resistant construction perforated gypsum lath shall be not less than $^3/_8$ in. in thickness with perforations not less than $^3/_8$ in. in diameter with one perforation for not more than each 16 sq. in. of lath.

Mortars for Unit Masonry

While many controversial opinions have existed concerning important technical points which would need to be covered in tests and specifications for mortars for unit masonry, persistent work on the part of Committee C-12 which functions in this field resulted in a decision to submit for publication as a tentative standard, specifications for mortars for concrete unit masonry. Such structures would normally be built with concrete units conforming to Specifications for Hollow Load-Bearing Concrete Masonry Units (C 90 – 39), Hollow Non-Load-Bearing Concrete Masonry Units (C 129 – 39), and Solid Load-Bearing Concrete Masonry Units (C 145 – 40).

Three grades of mortar are covered as follows: where a high degree of resistance to weathering is desired and where masonry is subjected to high stresses; where a moderate degree of resistance to weathering is desired and where masonry is subjected to ordinary stresses; and where weather resistance is a minor factor and low stresses are applied to the wall.

The properties of the materials are covered by existing A.S.T.M. standards—cement, lime, etc. There are requirements on water retention, compressive strength, and proportioning. For the three grades indicated above the average compressive strength at 28 days of three 2-in. cubes of mortar shall not be less than the following: Grade SW—2500 psi.; Grade MW—600 psi.; Grade NW—250 psi.

Research work being carried on by the committee will be continued including investigations on the effect of total suction and rate of suction on the strength and bond of mortars. Methods of measuring plasticity and workability of these materials will also be studied in addition to the flow table method on which considerable work has already been done.

At its December meeting the committee developed changes in the specifications covering aggregates for masonry mortar (C 144 – 39 T) which were approved by subsequent letter ballot and will be incorporated this year.

Manufactured Masonry Units

In order that its specifications might be as up to date as possible for inclusion in the 1942 Book of Standards, Committee C-15 on Manufactured Masonry Units took a number of actions at the Cleveland meeting. One of these affected the Specifications for Glazed Building Units (C 126 – 39 T) which cover brick tile and other masonry building units of clay or shale with a finish consisting of a vitreous glaze, excluding natural salt glazed ware. The proposed changes will be offered to the Society.

The committee approved new specifications covering facing tile and after referring the proposals to letter ballot, they will be submitted to the Society for publication. Two proposed revisions of the Methods of Sampling and Testing Brick (C 67 – 41) had been prepared: (1) covering initial rate of absorption (suction); and (2) the efflorescence or wick test. The latter, a five-day wick test, is to be studied further but the test covering suction of brick has been approved and will be voted on for immediate adoption.

The committee proposes to include in its annual report as an appendix a paper giving results of the freezing and thawing test, to be prepared by J. W. McBurney.

Thermal Insulating Materials

Due to the urgent needs resulting from the war effort, Committee C-16 on Thermal Insulating Materials decided to table its original plans for separate meetings of its subcommittees and proceeded immediately with the formulation of specifications that could be used during the emergency in the purchase of thermal insulating materials.

Four special committees or groups held separate meetings in Cleveland to consider the following types of thermal insulation:

1. Preformed block type thermal insulating materials in its various shapes, such as section or segmental pipe coverings, etc., particularly for industrial uses in the high-temperature ranges. This includes the various insulating materials used in this type of insulation, such as rock wool,

asbestos, glass wool, 85 per cent magnesia, vermiculite, diatomaceous earth materials, and laminated asbestos felts.

2. Thermal insulating cements of all types including rock wool, asbestos, glass wool, 85 per cent magnesia, and vermiculite, such materials being suitable not only for industrial use, but also for application in connection with domestic and apartment steam heating.

3. Blanket type, flexible, and loose-fill thermal insulating materials for both domestic and industrial uses including rock wool and glass wool in bat and blanket form and loose-fill insulation of rock wool, glass wool, and vermiculite all of which are suitable for use in the normal temperature ranges.

4. Structural insulating board.

The work of these groups resulted in the preparation of a number of draft specifications which will be further reviewed by the committee during the coming weeks. It was decided to hold the next meeting of Committee C-16 during the A.S.T.M. annual meeting in Atlantic City instead of waiting until the fall. It is expected that the committee may be able to take final action at that time on these emergency specifications.

The A.S.T.M. through Committee C-16 has been cooperating with the American Society of Heating and Ventilating Engineers, The American Society of Refrigerating Engineers, and the National Research Council, Division of Eng. and Industrial Research, in the formulation of test procedures for the measurement of thermal conductivity of various types of thermal insulation. This work extending over several years has resulted in the completion of the guarded hot plate method which was further discussed at a meeting held on Friday, February 6. This method has recently been the subject of an extensive cooperative testing program to determine the reproducibility of results obtained by different laboratories. The program has been satisfactorily completed and it is expected that the method will be made available through the Society later this year.

Paint, Varnish, Lacquer, and Related Products

The meetings of Committee D-1 on Paint, Varnish, Lacquer, and Related Products extended over three days with some 18 subcommittees and sections convening.

At the conclusion of the D-1 meeting, Secretary M. Rea Paul, Consultant to Protective Coatings Section, Division of Purchases, War Production Board, presented a very interesting summary of the activities of the WPB Protective Coatings Section. He outlined briefly a few of the problems that the section has had to consider as a result of the scarcity of many of the raw materials used in organic coatings, such as pigments, oils, lacquer, solvents, and diluents, soaps, fats, glycerin, resins, naval stores, etc. Additional problems are certain to develop with decreasing supply of some of these materials and the division is making every effort to obtain satisfactory substitutes. He referred to the close cooperation with industry which had greatly facilitated the formulation of the number of emergency alternate Federal specifications for pigments and other paint materials and for organic protective coatings that have been issued up to this time.

Committee D-1 through its various subcommittees is actively cooperating in adjusting existing specifications and test methods for paint materials to meet the needs of industry and for civilian and consumer needs. This cooperation has been most helpful in furthering production of substitutes for many needed paint materials.

A new subcommittee was organized jointly with Committee D-4 on Road Materials to give consideration to traffic paints. The consumption of this type of paint for marking traffic lines and safety zones on roads and pavements and also in industrial establishments has grown to very large proportions. The subcommittee is proceeding immediately to develop quick methods of test for determining satisfactory application and durability of traffic paint and will make further intensive studies.

Another new subcommittee has been organized on bituminous emulsions. This committee will consider such emulsions as a coating for concrete or metallic structures for the purpose of making it waterproof and increasing its resistance to corrosion. Methods for testing such emulsions are being developed and it is expected that the subcommittee may soon be able to prepare purchase specifications for these bituminous coatings.

Studies are continuing of different means proposed for making accelerated service tests on organic protective coatings. Methods for standardizing the gradings of the results of tests are also receiving consideration. Methods for grading the resistance of house paint films to such failures as chalking, checking, cracking, scaling, and flaking are in course of preparation. These will be useful to divide relative degree of failures and help in cooperative tests of a technical nature, as well as for determining when repainting of structures may be in order.

The salt spray test was discussed at some length since a number of variations of this are finding increasing use in the examination of paint coatings. The committee acted to present as an emergency provision a recommendation that where such tests are used, the A.S.T.M. Tentative Method of Salt Spray Testing of Non-Ferrous Metals (B 117 – 41 T) may be used for the testing of organic protective coatings.

This subcommittee has been cooperating with another group in outdoor exposure tests of the preparation and painting of structural iron and steel. Test panels have been exposed at two locations to determine whether such tests would demonstrate the relative merits of methods of surface preparation including the use of certain inhibitive chemical solutions and the use of mechanical methods of surface preparation such as sand blasting and wire brushing. The results after an exposure of 28 months were reported and confirmed in general the observations made after an exposure of 22 months, as published in the 1941 *Proceedings*, Vol. 41, p. 322. A further inspection of the panels will be made in June. At the meeting of Committee D-1 color slides showing the extent of rusting that has taken place on these test panels were shown by J. W. Iliff.

The subcommittee on methods of analysis has completed a new method for determining the consistency of ready-to-use house paints, which test is an important consideration in the practical use of these paints.

The best service of aluminum paints requires that, in drying, the flakes of aluminum form a continuous layer of overlapping flakes, like shingles on a roof. The committee has further developed the original rough qualitative test of this property and this more precise quantitative method for the leafing of aluminum pigments will be submitted for publication as tentative. Methods for determining the suitability of extender pigments in mixed paints are being studied.

The subcommittee on varnish is studying tests for synthetic coatings and is surveying the existing methods used for testing the hardness and toughness of coating films. New methods for precision tests of the drying of varnish films are also being investigated.

The subcommittee on pigments presented for publication, as tentative, new specifications covering the red pigment commercially known as "Chemically Pure Toluidine Toner." An extensive revision and expansion of the present Standard Specifications for Chrome Yellow (D 211 – 41) were reported in the form of new tentative specifications covering five types of commercially pure lead chromate pigments.

In the interest of increasing the production of basic sulfate white lead, there was approved as an emergency alternate provision a change in the permissible amount of PbO from a range of 15.0 to 28.0 per cent to 11.0 to 28.0 per cent. Possible needs for immediate revisions in certain of the other pigment specifications as a result of the scarcity of raw materials were discussed and a special subgroup was appointed to consider these matters, particularly any emergency alternate Federal specifications. Any actions will be referred to the subcommittee for approval.

Tentative definitions of six terms were agreed on: namely, lacquer, sanitar or tin plate lacquer, putty, bituminous varnish, glaze, and surfacer.

The completion of a revised method of test for spectral apparent reflectivity of paints which will replace the present Standard Method D 307 – 39 was announced.

Petroleum Products and Lubricants

In the work of Committee D-2 on Petroleum Products and Lubricants, the Subcommittee on Paraffin Wax approved minor changes in the proposed method for determining the oil content of paraffin wax by Methyl Ethyl Ketone extraction. The method is to be published this year for information. Additional cooperative work indicated the desirability of changing the paraffin wax melting point method (D 87) by recording the cooling period temperatures at 15 second intervals instead of the present specified 30-second periods, in which case five successive 15-second readings would be a criterion of the melting point instead of four 30-second readings.

Subcommittee VI on Color recommended that the photoelectric color method, upon which considerable cooperative work has been conducted, be published as information. The application of the procedure is limited as an alternate to the A.S.T.M. Union Colorimeter only, as more cooperative work will have to be conducted in order to ascertain if the instrument can be used as a replacement for the Saybolt Chromometer. It was the feeling of the subcommittee that the photoelectric method should not be adopted as a displacement of present methods so long as there is any question of the industry being able to obtain sufficient supply of the instruments during present emergency conditions.

The Subcommittee on Viscosity considered complaints that the modified Ostwald viscosimeter tubes purchased from different suppliers were not interchangeable in the baths because the distance between the two tubes was not specified. The chairman of the subcommittee was authorized to secure the proper dimension and incorporate it into the tube specification.

To minimize the number of types of viscosimeters and the standard temperatures at which viscosity is determined, the chairman of the Viscosity Subcommittee will appoint a special section to cooperate with Committees D-4 on Road Materials and D-9 on Electrical Insulating Materials to accomplish the purpose. The committee (Messrs. Geniesse and Tuemmler) reported that the cooperation of the other committees was assured.

The Subcommittee on Neutralization Number and Saponification suggested a number of minor changes to be made in the two new neutralization number methods which were published in 1941 in the compilation of A.S.T.M. Standards on Petroleum Products and Lubricants for information and that the methods be approved as tentative standards. Predicated upon the publication of these methods the present method (D 188) will be withdrawn.

It was reported that a survey was being made of all available hydrocarbons to determine their usefulness as vapor pressure standards.

"High-Speed Photography of Vocal Cords"

Honorable Mention, Professional, in the Fourth A.S.T.M. Photographic Exhibit, by J. H. Waddell, Bell Telephone Laboratories

Subcommittee on Carbon Residue recommended that the Ramsbottom method (D 524 – 41 T) be advanced to standard status.

Technical Committee A on Gasoline submitted a number of changes in the motor fuel knock test method (D 357 – 41 T) but the modifications will not involve any basic change in the procedure.

The committee made a number of minor changes in the proposed aviation gasoline gum method which was published last year for information. It is to be continued in its present status.

Technical Committee B on Lubricants agreed that the so-called 36-hour Chevrolet Engine Oxidation Test should be published for information. It was decided that the procedure be accomplished bya résumé of the cooperative work performed and the data which has been accumulated.

Technical Committee C on Turbine Oils recommended that after the incorporation of a number of minor revisions in the draft of the procedure, the proposed rusting test be adopted as a tentative standard method.

The committee voted to hold the annual D-2 dinner in conjunction with the annual meeting of the Society in Atlantic City, June 22–26. Dr. L. C. Beard, Jr. of Socony-Vacuum Oil Company was selected to be the guest of honor. Dr. Beard has been associated with the work of a large number of the subcommittees and technical committees of D-2.

Road and Paving Materials

In addition to the main committee meeting 11 subcommittees of Committee D-4 on Road and Paving Materials met during Committee Week in Cleveland. Such matters as the extraction and recovery of constituents from bituminous mixtures, the study of viscosity and flow tests, emulsion tests, and solubility test methods were considered; also the development of tests for expansion joint materials, and further consideration of abrasion tests and other methods for determining the structural properties of mineral aggregates. Several minor revisions were recommended in the Tentative Specifications for Materials for Stabilized Base Course (D 556 – 40 T) and for Materials for Stabilized Surface Course (D 557 – 40 T).

The committee also approved revisions in the Standard Methods of Test for Determination of Bitumen (D 4 – 27) and for Proportion of Bitumen Soluble in Carbon Tetrachloride (D 165 – 27). The changes will clarify the scopes to indicate that the tests are intended for determining bitumen in materials containing at least 25 per cent bitumen; also a further amplification of the procedure in case there is some question involving the amount of mineral matter which may have passed through the filter. Reference will also be added to a procedure that may be followed in the event that there are water soluble salts present which are insoluble in carbon disulfide.

Action was also taken to revise the Tentative Specifications for Crushed Slag for Bituminous Macadam Base and Surface Courses (D 487 – 41 T) in line with the recommendations on standard sizes of course aggregate for highway construction.

Minor editorial changes recommended in the Standard Methods of Test for Softening Point of Tar Products (Cube-in-Water Method) (D 61 – 38) and for Softening Point of Bituminous Materials (Ring-and-Ball Method) (D 36 – 26) were approved. In the cube-in-water test, the revision comprises the addition of the double mold for preparing the asphalt cube specimens. In the ring-and-ball test the range of the thermometer is being changed from "30 to 160 C." to read "30 to 200 C." to agree with the requirements for the softening point thermometer in the A.S.T.M. Thermometer Specifications (E 1 – 39).

The abrasion test for aggregates has been the subject of considerable study in the committee, including the use of the Deval machine for the abrasion of rock (D 2 – 33) and also for the abrasion of gravel, test for toughness of rock (D 3 – 18), and the Los Angeles abrasion test for coarse aggregates (C 131 – 39). In 1939 the Los Angeles abrasion test was adopted as standard and the following year the Deval test for abrasion of gravel was withdrawn as a tentative method. Further study has indicated that the Deval machine is still used rather widely and the committee recommended that the method be again published by the A.S.T.M. as tentative. The committee is to study various points in connection with these test methods for abrasion.

Bituminous Waterproofing and Roofing Materials

Committee D-8 on Bituminous Waterproofing and Roofing Materials decided to eliminate as an emergency matter the requirements for zinc coating on nails in the Spec. for Asphalt Roofing Surfaced with (*a*) Powdered Talc or Mica (D 224 – 41 T) and (*b*) Coarse Mineral Granules (D 249 – 41 T). In the same field of asphalt roofing the standard covering materials surfaced with fine mineral granules (D 248 – 41 T) is to be withdrawn.

Several definitions of terms as agreed on in a subcommittee are to be referred for approval to the main committee. These cover asphalt, mineral filler, finely powdered mineral filler, rag roofing felt, saturated, dampproofing, and waterproofing. The definition of asphalt which has been proposed is as follows:

> "A black to dark brown cementitious material which occurs in nature as such or is produced industrially from petroleum or mixtures of these two materials which gradually liquefies when heated, and in which the predominating constituent is solid or semi-solid non-benzenoid bitumen."

It was announced that new specification requirements for asphalt siding are being drafted. The Spec. for Asphalt-Saturated Roofing Felt for Use in Waterproofing and in Construction Built-Up Roofs (D 226 – 41 T) are being revised slightly and will be voted on for adoption.

One of the physical test requirements for coal-tar saturated roofing felt (D 227 – 41) has been that at least 8 out of 10 strips shall not crack when bent 90 deg. at a uniform speed over a rounded corner of 1/2-in. radius. This requirement is being tightened by recommending for immediate adoption that *all* of the strips shall meet this test. This requirement will then be in line with a new Federal specification now in course of preparation.

The specifications covering asphalt saturated asbestos felt (D 250) are being revised and because of this the standard is to be reverted to a tentative specification. Another weight of material will be added and other important changes are being drafted.

The committee announced the completion of new specifications for asphalt saturated and coated asbestos felt. In

manufacturing this material, a single thickness of asbestos felt is saturated with an asphaltic saturant, coated with asphalt coating, and surfaced with sufficient mineral matter to prevent sticking in the rolls. Also, a new specification for strip roofing coal-tar pitch has been agreed on.

After incorporation of certain changes the Tentative Specifications for Woven Cotton Fabrics for Use in Waterproofing (D 173) are to be adopted as standard. Requirements for another type of asphalt are to be included in the Specifications for Asphalt for Dampproofing and Waterproofing (D 449 – 37 T).

Rubber Products

Critical Rubber Situation Dictates Many Emergency Actions

The critical situation with respect to crude rubber and limited supplies of reclaim was the undercurrent which motivated some of the most important actions ever coming from Committee D-11 on Rubber Products at its all-day Wednesday meetings in Cleveland. A group of technical authorities representing both consumers and producers of many products in which rubber is an important element, conscious of their deep responsibility in conserving wherever possible the present supplies, reached accord on numerous alternate emergency provisions which will be pushed through the Society's procedure immediately with publication of the details scheduled within the next few weeks. A highlight of the meeting was an important report on Cooperative Test Program on Accelerated Light Aging of Rubber which represented a very substantial beginning of active progress and advancement in this field.

Mechanical Rubber Hose (Subcommittee I).—While no recommendations were received on fire hose, the committee plans to develop emergency alternate specifications after the section in charge has reported on revisions under way.

Insulated Wire and Cable (Subcommittee V).—One of the most active groups was concerned with insulated wire and cable. A special section which had devoted considerable time and effort in reviewing the current specifications offered several emergency changes in the interest of conservation. These actions include a reduction in the electrical and physical properties which must be met by the rubber compounds for insulated wire and cable, class AO 30 per cent Hevea type, with related action in heat-resisting rubber compound wire and cable and the ozone-resistance type of insulation. Approval of action taken on electrical conductors conserving tin and a provision that cable tape needs to be frictioned on one side only instead of the present requirement of both sides, with an insulated compound that is not injurious were other matters acted on. As an example of reduction in physical properties in D 353 – 41, Performance Rubber Compound, the tensile strength for rubber insulation is being reduced from 1200 to 850 psi. and the electrical constant lowered from 4000 to 2000.

To make available requirements for rubber sheath for cords and cables for use where extreme absorption is not encountered, a complete emergency alternate specification was approved setting up a tensile strength minimum of 1800 psi., a maximum set in 2-in. gage length of $^3/_8$ in. Elimination of the tensile stress requirement (500 psi. minimum at 200 per cent elongation) and reduction in the aging requirements was set up in the standard for so-called tough jacket compound covered by Standard D 532. This specification requires a minimum tensile strength of 3500 psi. and $^1/_4$-in. set.

No action was taken on the recommendation of the test section which had been investigating moisture absorption tests. A later report is anticipated.

Abrasion Tests for Rubber Products (Subcommittee XIV).—The research work on abrasion tests for rubber products is to be continued with a program under way on correlation of the Williams and Bureau of Standards type of machines. Tests for cord belting are under consideration and further discussion of this matter will ensue.

Packings (Subcommittee VI).—The meeting of the subcommittee on packings was featured by a most interesting paper presented by F. C. Thorn on "A Reciprocating Test Machine." This paper is scheduled for early publication in the ASTM Bulletin and is of important emergency interest because of the necessity of a satisfactory and quick method of evaluating packings. Considerable progress was reported in the development of test methods for compressed asbestos sheets with indication that they would be ready for action in June. This work in which contact was made with the Society of Automotive Engineers is of considerable interest in aircraft work. Treated paper packings using synthetic resins are to be studied immediately and test methods prepared.

Tests of Liquid Rubber Products (Subcommittee XXI).—The committee concerned with tests of liquid rubber products reviewed the Method for sampling and Testing Rubber Latex (D 640 – 41 T) with favorable comments resulting. This group also acted to request the adoption of the standard on rubber cements (D 553) issued in 1939. Since quite a number of interests have been anxious to obtain the falling cylinder viscosimeter required in D 553 and with present conditions making it difficult for the instrument maker to supply this, an effort is to be made to have this situation ameliorated.

The work on developing tests for adhesive strength of rubber and rubber-like films is being advanced and considerable progress will be reported in June. Special work will be done on adhesion tests in conjunction with cemented balloon seams.

Hard Rubber.—In the work on hard rubber the section on physical testing will attempt to complete a new round-robin test program on tensile testing in time so that results can be presented at the annual meeting in Atlantic City. These also will provide a check on the reliability of the test methods covering hard rubber products.

Testing Asphalt Composition Battery Containers.—There was much discussion on the now increasingly important tests for asphalt composition battery containers (D 639) on which the committee had received a number of comments from the National Bureau of Standards. A number of suggestions will be incorporated into the tests issued last year and others are to be considered further with the Bureau. In view of the probable increase in the use of asphalt containers the speed of testing is of extreme importance and discussion brought out the soundness of the requirement in D 639 of the rate of travel of the jaw of 0.2 in. per min. instead of 0.4 in. per min. as specified in the usual tensile test of rubber products.

Accelerated Aging of Rubber.—As previously indicated there was intense interest in the Report on Accelerated Light Aging of Rubber as presented by J. H. Ingmanson, Chairman of the Subcommittee. There were extensive tabular data and diagrams in the report. Ten laboratories cooperated in the work using three existing commercial testing machines and some laboratories conducted outdoor exposure tests. Material covered included neoprene, tire tread, hose cover, sidewall, insulation, and so forth.

Another phase of this aging program was correlating the results using a temperature in the bomb aging test (D 572) at 70 C. with 80 C. The existing requirement of 70 C. is to be retained, withdrawing a proposed provision setting up 80 C. as the temperature; but in line with this action revisions will be proposed in the methods so that an 80 C. temperature will be incorporated as alternate in the oxygen bomb test (D 572) and 90 C. alternate in the oven method (D 573) as compared with the present 70 C. operating temperature.

Hardness Testing.—The subcommittee concerned with rubber products for absorbing vibration is definitely interested in hardness testing and has followed closely the work of Technical Committee A (jointly sponsored by A.S.T.M. and S.A.E.) covering automotive rubber. A report from the latter was approved with its recommended proposed method of test using the durometer; this is to be approved as an emergency method. A report and details are published elsewhere in this BULLETIN. The committee plans to establish standard instruments in some ten laboratories for assistance in calibration and checking other instruments and then with careful standardization of the indentor, spring calibration, and other essential points to make use of the instrument at least during this emergency period.

Changes in Soap Standards

New York Meeting of Committee D-12

IN LINE WITH THE effort of the Society to keep A.S.T.M. standards abreast of changing conditions the meeting of Committee D-12 on Soaps and Other Detergents, held at the Hotel New Yorker, New York City, March 9 and 10, brought forth a considerable number of recommendations on emergency alternate provisions in the standards under its jurisdiction in addition to the actions taken as part of the regular work of the committee to recommend to the Society two new specifications and to revise certain existing standards.

Emergency alternate provisions are being recommended in the following specifications

Milled Toilet Soap (D 455 – 39)
White Floating Toilet Soap (D 499 – 39)
Salt-Water Soap (D 593 – 40 T)
Built Soap, Powdered (D 533 – 41)
Olive Oil Solid Soap (Type A, Pure; Type B, Blended) (D 592 – 41 T)
Olive Oil Chip Soap (Type A, Pure; Type B, Blended) (D 630 – 41 T)
Palm Oil Chip Soap (Type A, Pure; Type B, Blended) (D 536 – 41 T)
Palm Oil Solid Soap (Type A, Pure; Type B, Blended) (D 535 – 41)

By these emergency provisions a rosin content up to 10 per cent, based on the finished product, would be permitted in Specifications D 455, D 499, and D 593. Requirements for titer would be eliminated from Specifications D 533, D 592, and D 630. Provisions in D 593, D 592, D 630, D 536, and D 535 would take into account the scarcity of certain materials such as palm-kernel oil, cocoanut oil, and olive oil, and the necessity for using other more readily available materials in their places where possible. In addition it was recommended that the requirement for acid number and the word "white" describing the color of the soap should be eliminated from Specifications D 499.

The committee also wishes to call attention to the fact that with respect to all of the soap specifications "the soap must be made in conformity with the regulations of the War Production Board with reference to content of glycerine, fat stocks, etc., anything in the specifications to the contrary notwithstanding."

As part of its regular work Committee D-12 acted on the following recommendations to the Society:

Proposed Specifications for: Chip Soap with Rosin, Powdered Soap with Rosin

Adoption as Standard of: Tentative Specifications D 592 (Live Oil Solid Soap), D 630 (Olive Oil Chip Soap), D 536 (Palm Oil Chip Soap), and D 593 (Salt-Water Soap)

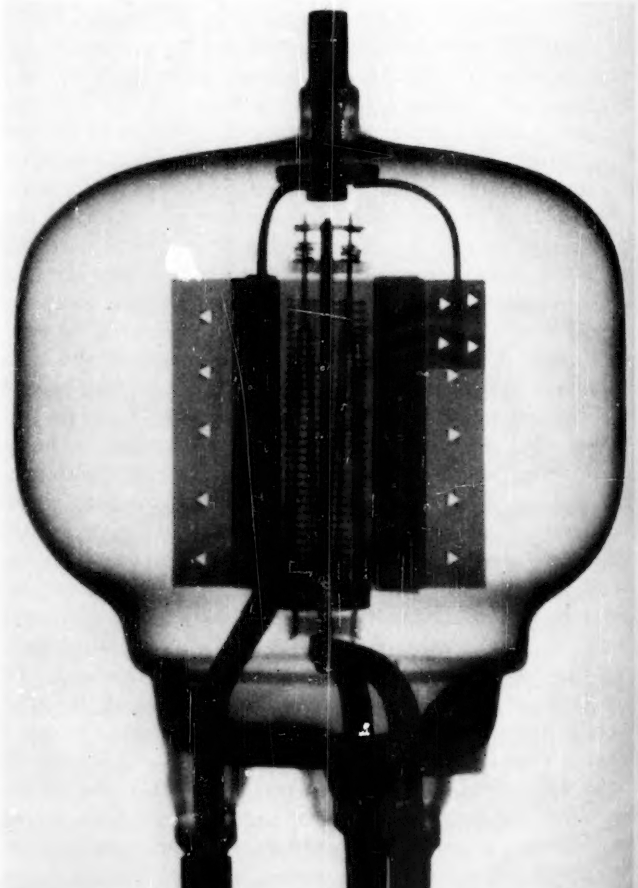
Editorial Change in: Specifications D 534 (Alkaline Soap Powder)

Revision and Continuance as Tentative of: D 595 (Tetrasodium Pyrophosphate)

Continuance as Tentative, Without Revision, of: Specifications D 538 (Trisodium Phosphate)

"X-ray of Vacuum Tube"

Awarded Third Prize, Professional Class, Fourth A.S.T.M. Photographic Exhibit, by J. H. Waddell, Bell Telephone Laboratories, Inc.



Notes on War Production Board Setup and Personnel

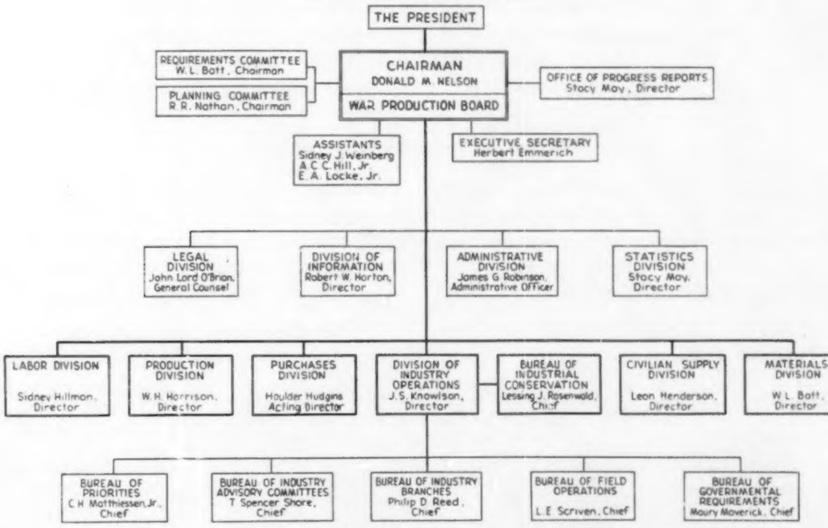
Divisions of Materials, Industry Operations, Production, and Purchases—Bureau of Industrial Conservation, Iron and Steel Branch, National Emergency Steel Specifications, Industry Branches

Editor's Note.—Because the work of the War Production Board is most important and since practically every member of the Society and Bulletin readers are interested in its work, and many are vitally concerned with the activities—indeed a large number of members are actually working in the Board—and because of recent developments in the Board of far-reaching importance, an attempt is made here to outline the general setup of the War Production Board with information in the form of charts and lists of personnel that it is hoped will be of interest and service. This information is not intended to be complete and it is most important to understand that with many changes constantly going on in personnel and in the setup, it may not be 100 per cent accurate at the time it reaches the reader. The material is based on information obtained at first hand and from charts and statements released by the War Production Board and is information which is accessible to any business or journal editor.

A Summary of What Is Presented

1. Chart of War Production Board
2. Personnel information on Materials Division and its branches covering iron and steel and other metals and alloys, and condensed notes on the National Emergency Steel Specifications work
3. Division of Industry Operations and information on its Industry Branches—*one of the most important recent Washington reorganizations*
4. Chart of the Bureau of Industrial Conservation, with notes
5. Information on personnel in the Production, Purchases and other divisions, Office of Defense Transportation, etc.

WAR PRODUCTION BOARD



Materials Division[1]

Director: W. L. Batt
Executive Assistant: C. E. Rhetts
Deputy Director: A. I. Henderson

Technical Consultant: C. K. Leith
Head Priority Specialist: H. K. McCook
Information: Russell Hogin

Aluminum and Magnesium Branch:
Chief: A. H. Bunker

Chemical Branch (Chemicals, Protective Coatings, Synthetic Rubber):
Chief: E. W. Reid

Iron and Steel Branch:
Chief: C. E. Adams
Deputy Chief: R. C. Allen
Executive Assistants: S. S. Lowe, L. S. Simons

[1] In this division and others no attempt is made here to give the complete personnel, but information has been selected which might be of most interest and service to A.S.T.M. members. Where there was an office of information in a division or branch, it is listed, since members could obtain further data probably most easily by contacting this individual.

Metallurgical and Specification Sections (see notes below)

Plant Facilities Section:
Assistant Branch Chief: R. C. Allen
Coordinator: P. T. Homan
Planning Unit: W. A. Hauck
Record Unit: B. C. Moise
Repair Order Unit: F. W. Weidman
Construction Unit: D. N. Watkins

Control Section:
Assistant Branch Chief: R. L. Houston
Special Assistant: C. S. Long
Administrative Unit: G. C. Hinckley
Statistics: G. R. Kinzie
Information: R. Hogin

Allocations and Priorities Section:
Assistant Branch Chief: S. B. Adams
Priorities Unit: E. B. Mason
Priorities Review Unit: P. J. Treacy
Allocation Review Unit: A. J. O'Leary
Distressed Stocks Unit: J. R. Stayman
Lend-Lease Unit: P. F. Schucker
Civilian Supply Unit: E. W. Gifford

Raw Materials Section:
Assistant Branch Chief: F. E. Vigor
Pig Iron Unit: W. Kerber
Scrap Unit: A. Miller
Iron Ore Unit: S. O. Hobart
Fuel Unit: E. Holley, S. Weiss
Refractories and Fluxes Unit: D. N. Watkins

Please turn page for continuation of Iron and Steel Branch

Products Section: (NOTE: The personnel in the units indicated include many industrial specialists and analysts.)
Assistant Branch Chief: Charles Halcomb
Liaison Army, Navy, Maritime: R. W. Shannon
Hot-Rolled Bars and Semifinished Unit: W. F. Vosmer, A. A. Wagner
Cold-Finished Bar Unit: G. B. Sheers
Tin Plate Unit: C. A. Kinkaid
Rail Unit: O. H. Baker
Wire Unit: W. G. Hume
Warehouse Unit: J. R. Stuart
Plates and Shapes Unit: M. W. Cole
Forgings and Castings Unit: G. Hocker
Hot-Rolled Alloy Unit: M. Brace
Pipe Unit: D. Lacy
Tubing Unit: E. S. Moorehead
Sheet and Strip Unit: L. F. Miller

POWER BRANCH (Power, Gas Water Supply, Public Sanitation):
Chief: J. A. Krug

CORK AND ASBESTOS BRANCH:
Chief: F. W. Gardner
NICKEL BRANCH (Nickel, Monel, Nickel Alloys other than Ni Steel):
Chief: Harry A. Rapelye
TUNGSTEN BRANCH (Tungsten, Molybdenum, Vanadium, Cobalt, Antimony, Beryllium and Ferroalloys of Same):
Chief: H. K. Masters
COPPER BRANCH:
Chief: H. O. King
Copper and Brass Section:
Unit Chief: E. H. Hammond
Copper and Brass Mill Products and Brass Munitions Section:
Unit Chief: J. W. Douglas
Scrap Copper and Copper Alloy Section:
Unit Chief: Michael Schwarz
Copper Conservation Appeals Section:
Chief: Sydney Tyler
ZINC BRANCH (Zinc, Oxide and Slab Zinc):
Chief: D. A. Uebelacker
Assistant Chief: G. C. Heikes

Allocation Section:
Chief: M. L. Trilsch
Production Section:
W. C. Page
TIN-LEAD BRANCH (Lead, Tin, Ilmenite Pigment, Antifriction Bearing Metals, Solders):
Chief: Erwin Vogelsang
MANGANESE-CHROME BRANCH (Manganese, Chromium, Silicon, Zircon, Columbium, Tantalum, Titanium, Rutile, Spiegeleisen and Ferroalloys):
Chief: Andrew Leith
MICA-GRAPHITE BRANCH (Mica, Graphite, Gypsum, Magnesite, Cryolite, Fluorspar, Cadmium, Bismuth, Indium, Gallium):
Chief: H. F. Wierum
MISCELLANEOUS MINERALS BRANCH (Mercury, Industrial Diamonds, Quartz Crystals, Platinum group metals, Radium, Uranium, Kyanite, Abrasives, Diamond Dies, Jewel Bearings)
Chief: R. J. Lund

A most important recent change in the Iron and Steel Branch, which has been announced, is the appointment of H. J. French, The International Nickel Co., as Senior Consultant, Metallurgical and Specifications Section. The work of the sections headed by G. B. Waterhouse and H. LeRoy Whitney, and another section on Tool Steels, head to be named, will clear through Mr. French, who will report direct to C. E. Adams, branch chief. The metallurgical and specifications work has increased tremendously throwing extremely heavy burdens on the section heads, and with increased work in sight, a move of this nature which will remove some of the tremendous executive pressure on the technical people in these sections is considered most constructive. Further announcements of the complete setup will be made. A number of A.S.T.M. members are at work in the Metallurgical and Specification Sections, including R. L. Wilson, Edwin Joyce, and E. J. Hergenroether.

National Emergency Steel Specifications Work.—Another article in this BULLETIN covers further work on National Emergency Steel Specifications which is being carried on under the War Production Board by C. L. Warwick, Administrator of the project, through cooperation of the American Iron and Steel Institute, Society of Automotive Engineers, and American Society for Testing Materials. Edwin Joyce, Industrial Specialist in the Iron and Steel Branch, devotes a large portion of his time to the NESS work as assistant to Mr. Warwick. All this work is tied in directly with the branch through the new Senior Consultant, H. J. French. While the work has been little publicized, very important progress has been made. See the accompanying article (page 64).

Division of Industry Operations

The Division of Industry Operations, one of the main parts of the War Production Board, is in turn made up of several branches as the condensed personnel list below indicates. Very recently, one of the most important of these bureaus—that on Industry Branches—has been completely reorganized. The importance of these branches cannot be overemphasized, as the purposes and duties of the branches and the chiefs definitely indicate. Furthermore, the work of the branches should be of much interest to A.S.T.M. members and those in the materials fields because in each of the product branches considerable conservation work will eventually be carried out.

Director: James S. Knowlson
Executive Officer: Sidney Sherwood
Executive Assistant: Karl K. Tranum
Administrative Assistant: Kenneth N. Clark

BUREAU OF INDUSTRY ADVISORY COMMITTEES:
Chief: T. Spencer Shore
Assistant Chief: Kenneth Watson
Executive Assistant: S. H. Dykstra

BUREAU OF FIELD OPERATIONS:
Chief: L. E. Scriven
Deputy Director: P. M. McCullough
Chief of Field Priorities: F. R. McGregor
Sr. Administrator Officer: Rex Land
Sr. Administrative Assistant: J. E. McCabe
NOTE: (Several sections are set up on Administration, Purchases, Civilian Supply, Materials, Housing, Maintenance and Repair, Emergency Clearance)

BUREAU OF PRIORITIES:
Chief: C. H. Matthiessen, Jr.
Deputy Chief: John P. Gregg
Special Assistants: Arthur Harris, J. W. Peters
Assistant Chiefs: Internal Operations, Clem C. Crossland; Policy, John H. Martin; Enforcement, L. J. Martin; Requirements, Henry P. Nelson; Priority Specialist, Samuel S. Stratton
Head Priority Specialists in WPB Divisions: Production, W. G. W. Glos; Materials, H. K. McCook; Industry Operations, Joe M. Tucker; Office of Petroleum Coordinator, James E. Hughes
A full staff of priority specialists has been assembled for assignment to all of the industry branches in the War Production Board. These priority specialists work with the industry branch chiefs of the Divisions of Industry Operations, Materials, and Production, in the preparation of priority orders and assignment of priority ratings. One or more priority specialists are assigned to each of the industry branches in the three divisions.

BUREAU OF INDUSTRY BRANCHES:
Chief: Philip D. Reed
Deputy Chief: Armory Houghton
Assistant Bureau Chiefs: John R. Kimberly, Joseph R. Taylor
Executive Assistant: Marshall Dodge
A number of the branches which are listed below are under the coordination of J. R. Kimberly. Some report through J. R. Taylor and several report direct to the Bureau and Deputy Bureau Chief. A list of the important industry branches with the chiefs in charge and their previous industrial connections is as follows:

1. Automotive—Ernest Kanzler (President, Universal Credit Co.)
2. Rubber and Rubber Products—Arthur Newhall (Executive Vice-President, Talon, Inc.)
3. Textiles, Clothing and Leather Goods Ben Alexander (Acting Chief) (President, Masonite Corp.)
4. Food Supply—D. C. Townson (President and Treasurer, Curtice Brothers Co.)
5. Consumers Durable Goods—L. C. Upton (President, Nineteen Hundred Corp.)
6. Pulp and Paper—David J. Winton (Chairman of the Board, Winton Lumber Co.)
7. Printing and Publishing—George Renard (Executive Secretary and Treasurer, National Association of Purchasing Agents)
8. Service and Distribution, Office and Service Machinery—Nathaniel G. Burleigh (Professor of Industrial Management, Dartmouth College)
9. Special Industrial Machinery—Lewis S. Greenleaf, Jr. (Industrial Sales Manager, Behr-Manning Corp.)
10. Construction Machinery—A. Stevenson (Acting) (Securities Analyst, Securities and Exchange Commission)
11. Air Conditioning and Commercial Refrigeration—J. M. Fernald (General Manager, Baker Ice Machine Co.)
12. Transportation—A. Stevenson
13. Communications—Leighton Peebles (Supervising Utilities Analyst, Securities and Exchange Commission)

14. Farm Machinery and Equipment—William R. Tracy (Vice-President, Pontiac Motors Division of General Motors Corp.)
15. General Industrial Equipment—Charles S. Williams (Chairman of the Board of Directors, Thomas A. Edison, Inc.)
16. Health Supplies—William M. Bristol, Jr. (Vice-President and Director, Bristol Myers Co.)
17. Toiletries and Cosmetics—H. T. Rosenfeld (Acting) (President, Los Angeles Paper Bag Co.)
18. Safety and Technical Equipment—H T. Rosenfeld
19. Plumbing and Heating—W. W. Timmis (President, Au-Temp-Co Corp.)
20. Lumber and Lumber Products—John Haynes (Acting) (Senior Security Analyst, Securities and Exchange Commission)
21. Building Materials—John Haynes
22. Containers—Douglas Kirk (Assistant to the Vice-President of Purchases, Quaker Oats Co.)
23. Furniture and Bedding—John M. Brower (President and General Manager, Brower Furniture Co.)
24. Beverages and Tobacco—J. B. Smiley (Retired President and Chairman of the Executive Committee, Remington Arms Co.)

Permanent branch chiefs are being appointed to replace those now designated as acting. Each of the men now designated as acting branch chief is also permanent chief of another branch.

Mr. Houghton was Board Chairman, Corning Glass Works; Mr. Kimberly, Director of Mfg., Kimberly Clark Corp., and Mr. Taylor, Purchasing Agent, Socony Vacuum Oil Co., N. Y.

The following excerpts from a WPB news release with quotations from the WPB Division Administration Order No. 2 will indicate the great importance of the work of this bureau and its 24 branches:

"The main task of each branch chief will be to bring about maximum use of existing industrial capacity within the industry. . . . He will assist . . . in every phase of its production program, including conversion, financing of new or expanded facilities, problems of labor supply, and procurement of materials and equipment. . . . His authority is drawn from the WPB Chairman (Nelson), through the Director of Industry Operations (Knowlson), through the Chief of Bureau of Industry Branches (Reed).

"The branch chief has the following responsibilities:
1. To serve as the focal point for all WPB business of the industry assigned to him. . . .
2. To ascertain . . . the military requirements of the Army, the Navy, and the United Nations and the civilian requirements. . . .
3. To ascertain the existing industrial capacity within the industry . . . to ascertain opportunities to enlarge the productive capacities. . . .
4. When conversion is necessary to obtain maximum use of such capacity for war purposes. . . .
5. Working with representatives of the Production Division and the Purchases Division, to assure prompt placement of war contracts and subcontracts. . . .
6. With the assistance of the Priority Specialist, to devise such priorities, allocation or limitation orders as may be necessary. . . .
7. With the assistance of the representative of the Bureau of Industrial Conservation. . . to conserve critical materials used by the industry in making military or civilian products or in plant or other construction projects, by substitution, re-design, review of specifications, or otherwise.

"The order prescribes that the staff of each branch chief shall include one or more duly assigned representatives of the Production, Purchases, Civilian Supply, Labor, Legal, Statistics and Materials Divisions of the War Production Board, and one or more duly assigned representatives of the Bureau of Priorities and the Bureau of Industrial Conservation of the Division of Industry Operations. Representatives may also be assigned from the armed services and other government agencies."

Representatives from other divisions of WPB so far assigned to Mr. Reed's staff are as follows:

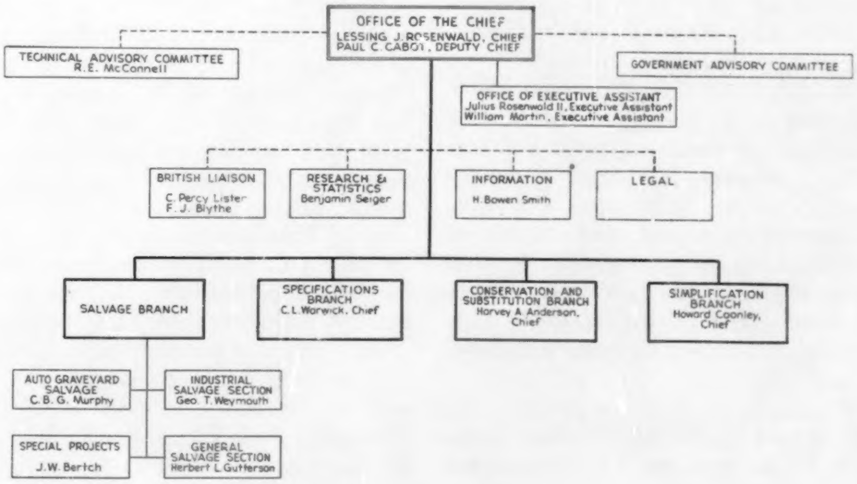
Labor Division—Richard A. Lester
Purchases Division—Houlder Hudgins
Statistics Division—Virgil Reid
Bureau of Industrial Conservation—Arthur W. Carpenter
Bureau of Priorities—Joseph Tucker
Executive Office of the Division of Industrial Operations—Eric Kohler

It will be noted that Arthur W. Carpenter, member of the A.S.T.M. Executive Committee who has been Consultant in the Conservation and Substitution Branch, Bureau of Industrial Conservation, has been assigned the important responsibility of arranging contacts for the BIC in the Bureau of Industry Branches.

Bureau of Industrial Conservation
(Reporting Through the Division of Industry Operations)

A detailed description of some important phases of the work of the WPB's Bureau of Industrial Conservation was published in the December ASTM Bulletin, page 7, referring specifically to the work of the Specifications Branch, of which the Chief is C. L. Warwick, Secretary-Treasurer, A.S.T.M., and the Conservation and Substitution Branch, headed by Harvey Anderson. The work of this Bureau has increased extensively in all phases, although the most notable expansion of personnel has been in the salvage branch, for reasons apparent to anyone. The accompanying diagram shows four sections functioning in this branch. The Personals Column in this Bulletin indicates a number of leading A.S.T.M. members who are active in BIC work, and it will be seen from the information above about the Bureau of Industry Branches that extensive conservation work is contemplated in each of the 24 branches, in which Arthur W. Carpenter is the BIC contact representative on the staff of Philip D. Reed. As phases of this important work develop, further announcements will be made, but it does mean still further expansion of the work, particularly of the Conservation and Substitution Branch and also the Specifications Branch. Noteworthy changes in personnel in the BIC are the appointment of Howard Coonley as Chief of the Simplification Branch, Mr. Coonley being Chairman of the Board of the Walworth Co., and very active in the work of the American Standards Association, and the appointment of Mr. Blodgett Gage as Administrative Deputy in the Specifications Branch. One phase of the specifications work—that on building materials—has been extremely intensive and continues under the direction of Henry Waples. He and his associates have transferred their offices to the Social Security Building, although most of the rest of the BIC are still in Temporary Building E, Fourth and Adams Drive.

BUREAU OF INDUSTRIAL CONSERVATION



WPB Production Division

Director: W. H. Harrison   Head Priority Specialist: W. G. W. Glos   Information: Alfred D. Charles

MACHINE TOOLS BRANCH (Industrial Supplies, Foundry Equipment, Heat-treating Equipment, Cranes, Woodworking Machinery):
Chief: George C. Brainard
SHIPBUILDING:
Acting Chief: Captain J. O. Gawne

ORDNANCE (Small Arms and Ammunition, Heavy Ordnance, Explosives, Optics, Communications, Production Scheduling):
Chief: E. F. Johnson
CONSTRUCTION:
Chief: W. V. Kahler

STAFF SERVICES:
Chief: George A. Landry
AIRCRAFT:
Chief: M. C. Meigs
CONTRACT DISTRIBUTION:
Chief: Walter Wheeler, Jr.

WPB Purchases Division

Acting Director: Houlder Hudgins   Executive Officer: Philip T. Maguire   Information: John T. Moutoux

NOTE.—Douglas C. MacKeachie, formerly Purchases Director, has recently been transferred to the War Dept. in its new streamlined setup and is Deputy Chief of Procurement and Distribution, assisting Brigadier-General C. D. Young (see separate news note in this BULLETIN). The new Acting Director of the Purchases Division, Houlder Hudgins, was formerly Deputy Director. He was President, Sloan-Blabon Corp. of New York City and formerly was in charge of purchases at Mandel Bros., Chicago. Previous to that he was Merchandise Manager for Montgomery Ward and before that, according to a WPB release, was Professor of Economics at Cornell University.

EQUIPMENT AND SUPPLIES BRANCH:
Chief: William L. James

ACCOUNTING AND DISTRIBUTION BRANCH:
Chief: Eric A. Camman

CONTRACT CLEARANCE BRANCH:
Acting Chief: Robert J. de Camp
PLAN SITE BOARD:
Chief: Edwin M. Martin

WPB Civilian Supply Division

Director: Leon Henderson   Deputy Director: Joseph Weiner

SUPPLY AND REQUIREMENTS BRANCH:
Chief: Dr. James W. Angell
SPECIAL STUDIES BRANCH:
Acting Chief: Dr. Arthur Burns

CONSUMERS PROGRAMS BRANCH:
Chief: Roland S. Vaile
INDUSTRIAL PROGRAMS BRANCH:
Chief: David L. Crawford

SERVICES PROGRAMS BRANCH:
Chief: Reavis Cox
PLANNING BRANCH:
Chief: Dr. Arthur Burns

Office of Defense Transportation

This office is not a part of the War Production Board but is set up under the Office of Emergency Management.

Director: Joseph B. Eastman
Acting Director, Section on Materials and Equipment: Philip A. Hollar

NOTE: Director Eastman announced early in March the appointment of C. D. Young in charge of a section on materials and equipment. With Brigadier-General Young's appointment as Chief of Procurement and Distribution, U. S. Army, Service of Supply under Lieut.-General Somervell, Philip A. Hollar has succeeded Mr. Young as acting director. Carroll W. Brown has been appointed assistant to Director Hollar.

Among the eight consultants appointed to advise Mr. Hollar on technical matters are the following:

F. H. Hardin—railroad freight, passenger, and all other types of cars
Jerome G. Bower—castings and miscellaneous items required in rail transportation manufacture and maintenance
Charles T. Ripley—steam, Diesel, and electric locomotives
H. L. Hamilton—Diesel engines for railroad propulsion equipment
Irving B. Babcock—buses, trucks, taxicabs, and replacement parts
Harold C. Davis—equipment and supplies for maintenance of buses and trucks
Robert F. Black—equipment on which production has been suspended (trucks, etc.)
A. L. Viles—rubber products, including tires, tubes, insulated wire, and belting and other mechanical rubber goods

Moore's Textbook on Engineering Materials

THE RECENTLY issued sixth edition of the "Textbook of the Materials of Engineering" brings up to date a publication which, while intended primarily for use in technical schools in connection with courses in the mechanics of materials and courses in the materials testing laboratory, is of interest to all who wish to become familiar generally with the properties of materials.

This book was prepared by Prof. H. F. Moore, University of Illinois, but the chapter on crystalline structure of metals was written by Prof. J. O. Draffin, also of the University of Illinois, and the very extensive chapter on concrete was written by H. F. Gonnerman, Manager, Research Laboratory, Portland Cement Association. Messrs. Moore, Draffin, and Gonnerman are all active members of the A.S.T.M. and this book contains numerous references to A.S.T.M. publications and excerpts therefrom including illustrative methods of test and specifications.

The material covered by this book is outlined as follows:

Introductory matter (Chapter I); basic properties of engineering materials (Chapters II and III); failure of materials by flow or creep, by fracture, and by corrosion and wear (Chapters IV to VI); working stress, factor of safety, and selection of materials (Chapter VII); crystalline structure of metals (Chapter VIII); production, characteristics, and uses of engineering materials including a newly added chapter on plastics and new matter on rubberlike materials (Chapters IX to XVIII); testing and inspection; testing machines (Chapter XIX); and specifications for materials (Chapter XX). Also included are an appendix on "Formulas in Common Use for Determining Stresses," and lists of questions on each of the chapters for the convenience of teachers who use this book as a text.

In this latest edition most chapters have been revised, with later test data used and most recent references incorporated, and rather extensive changes have been made in a number of the sections; also a new chapter on plastics was added. The discussion of testing and specifications ties in directly with A.S.T.M. work and Professor Moore has incorporated considerable descriptive matter covering the Society, including three sample specifications.

This 470-page publication, clearly printed on an excellent grade of paper, containing 158 helpful illustrations, and durably bound in cloth is obtainable from the McGraw-Hill Book Co., Inc., 330 West 42nd St., New York, N. Y., at $4 per copy.

List of Emergency Alternate Federal Specifications

A large number of Emergency Alternate Federal Specifications have been received at A.S.T.M. Headquarters and in line with the policy of announcing these, there are given below the specification number and brief description of the particular item. *However*, because the number received in the past few weeks is very large, an attempt has been made to list only those which would be of particular interest to a reasonable cross-section of A.S.T.M. members. We probably could justify listing all of the specifications, since every Federal specification would be of interest to some A.S.T.M. members and Bulletin readers, but such products as scissors, brooms, dishwashing machines, combs, etc., would certainly not be of interest from the standard or specification angle to many members, and therefore the list is confined chiefly to engineering materials and related products. Emergency Alternate Federal Specifications covering materials or products where the A.S.T.M. or any of its committees have done work are of direct interest.

As will be noted from the accompanying article, a list of all Emergency Alternate Federal Specifications up to January 26 can be obtained from A.S.T.M. Headquarters as long as the supply lasts.

Partial List of Emergency Alternate Federal Specifications

Specification Number	Description
E-CCC-B-811	Burlap; Jute
E-H-B-421	Brushes; Paint, Metal-Bound, Flat (High-Grade)
E-H-B-431	Brushes; Paint, Metal-Bound, Flat (Medium-Grade)
E-H-B-436	Brushes; Paint, Metal-Bound, Flat (Utility-Wall)
E-H-B-701	Brushes; Varnish, Flat (Double X Thickness)
E-H-B-706	Brushes; Varnish, Flat (Triple X Thickness)
E-HH-F-191	Felt; Asphalt-Saturated (for) Flashings, Roofing, and Waterproofing
E-HH-T-101a	Tape; Friction
E-HH-T-111a	Tape; Rubber, Insulating
E-J-C-103	Cable and Wire; Rubber-Insulated, Building-Type (0 to 5000-Volt Service)
E-JJ-H-571	Hose; Fire, Linen, Unlined (supersedes E-JJ-H-571, dated August 7, 1941)
E-JJJ-O-331	Oil; Linseed, Boiled
E-JJJ-O-336	Oil; Linseed, Raw
E-LLL-B-631a	Boxes; Fiber, Corrugated
E-LLL-B-636a	Boxes; Fiber, Solid
E-NN-B-591	Boxes; Wood-Cleated-Fiberboard
E-NN-B-601a	Boxes; Wood-Cleated-Plywood
E-QQ-A-334	Aluminum-Alloy (Aluminum-Chromium-Magnesium-Silicon); Plates and Sheets
E-QQ-A-353a	Aluminum-Alloy (AL-17) (Aluminum-Copper-Magnesium-Manganese); Plates, Sheets, and Strips
E-QQ-A-355	Aluminum-Alloy (AL-24), (Aluminum-Copper-Magnesium (1.5 per cent)-Manganese); Plates, Sheets, and Strips
E-QQ-A-367a	Aluminum-Alloy; Forgings, Heat-Treated
E-QQ-A-591	Aluminum-Base-Alloy; Die-Castings
E-QQ-A-596	Aluminum-Base-Alloy; Permanent-Mold-Castings
E-QQ-A-601	Aluminum-Base-Alloys; Sand-Castings
E-RR-R-571	Rope; Wire (supersedes E-RR-R-571, dated January 24, 1942)
E-T-R-601a	Rope; Manila (supersedes E-T-R-601a, dated November 12, 1941)
E-TT-B-601	Bone-Black; Dry, Paste-in-Japan, Paste-in-Oil
E-TT-C-231	Chrome, Green; Oxide
E-TT-C-236	Chrome, Green; Pure, Dry, Paste-in-Japan, Paste-in-Oil
E-TT-C-291a	Chrome-Yellow and Chrome-Orange; Dry, Paste-in-Japan, and Paste-in-Oil
E-TT-E-531a	Enamel, Water-Resisting, Red
E-TT-I-511	Indian-Red; Dry, Paste-in-Japan, Paste-in-Oil
E-TT-L-71	Lampblack; Dry, Paste-in-Japan, Paste-in-Oil
E-TT-O-111	Ocher; Dry, Paste-in-Japan, and Paste-in-Oil
E-TT-P-27	Paint; Graphite, Outside, Ready-Mixed, Black
E-TT-P-31a	Paint; Iron-Oxide, Ready-Mixed and Semipaste Red and Brown
E-TT-P-36a	Paints; Lead-Zinc-Base, Ready-Mixed, and Semipaste, White and Tinted
E-TT-P-53	Paint; Outside, Ready-Mixed, Medium-Chrome-Yellow
E-TT-P-59	Paint; Ready-Mixed, International-Orange
E-TT-P-61	Paint; Ready-Mixed, and Semipaste, Black
E-TT-P-71a	Paint; Ready-Mixed and Semipaste, Exterior, Chrome-Green
E-TT-P-81	Paints; Ready-Mixed, and Semipaste, Olive-Drab
E-TT-P-86	Paint, Red-Lead-Base; Linseed-Oil, Ready Mixed
E-TT-P-101a	Paint; Titanium-Zinc and Titanium-Zinc-Lead Outside, Ready-Mixed, White
E-TT-P-156	Paint; White-Lead-Base; Basic-Carbonate, Ready-Mixed, Light-Tints and White
E-TT-W-556a	Wood-Preservative; Coal-Tar-Creosote
E-TT-W-568	Wood-Preservative; Creosote-Petroleum-Solution
E-TT-W-571b	Wood-Preservative; Recommended Treating Practice
E-UU-P-31a	Paper; General Specifications
E-UU-P-268a	Paper; Kraft, Wrapping
E-UU-P-547b	Paper; Teletype, Roll and Tape
E-V-T-291a	Thread; Linen (supersedes E-V-T-291a, dated August 19, 1941)
E-W-B-616	Boxes and Outlet-Fittings, Floor; (for) Rigid-Steel-Conduit and Electric-Metallic-Tubing (Steel) (supersedes E-W-B-616, dated May 23, 1941)
E-W-F-406	Fittings; Cable and Conduit (supersedes E-W-F-406, dated May 23, 1941)
E-W-O-806	Outlet Bodies; Iron (Cast or Malleable), Cadmium- or Zinc-Coated, with Covers and Accessories (for Shore Use) (supersedes E-W-O-806, dated May 23, 1941)
E-W-O-821a	Outlet-Boxes; Steel, Cadmium- or Zinc-Coated, with Covers and Accessories (supersedes E-W-O-821a, dated May 23, 1941)
E-W-P-131a	Panelboards; Equipped with Automatic Circuit-Breakers
E-W-P-146	Panelboards; Equipped with Fuse-Connections, or Switches and Fuse-Connections (supersedes E-W-P-146, dated May 23, 1941)
E-WW-T-783a	Tubing, Aluminum (AL-2); Round, Seamless
E-WW-T-788a	Tubing, Aluminum-Alloy (AL-3) (Aluminum-Manganese); Round, Seamless
E-ZZ-C-811	Cushion (Underlay); Carpet and Rug, Sponge-Rubber
E-ZZ-H-451a	Hose, Fire; Cotton, Rubber-Lined

Emergency Alternate Federal Specifications

The Specifications Branch, Bureau of Industrial Conservation, War Production Board, has issued as of January 26 a complete List of Emergency Alternate Federal Specifications. This gives in sequence of the Federal Specification numbers the date and title of the respective specification and gives all of those issued up to January 26. A limited number of copies of this list are available from A.S.T.M. Headquarters and will be sent on request as long as the supply lasts.

In the accompanying article there is given a list of the latest Emergency Alternate Federal Specifications covering materials that would be of interest to members of the Society. Other lists have been published in previous Bulletins.

Important Progress in Emergency Steel Specifications Work

Work Will Result in Recommendations to War Production Board

While recent ASTM bulletins have included condensed news of the work on National Emergency Steel Specifications being carried on under War Production Board cognizance and sponsored by the A.S.T.M.-S.A.E.-A.I.S.I. with C. L. Warwick as Administrator, no official WPB releases, have been sent out pending definite actions by the Administrative Committee. The Bulletins have given the personnel of the technical advisory committees appointed, including the following:

December Bulletin:
- TAC 1 on Carbon Steel Plates
- TAC 2 on Alloy Steel Plates
- TAC 3 on Aeronautical Steels
- TAC 4 on Structural Steel Shapes

January Bulletin:
- TAC 5 on Rails and Track Accessories
- TAC 6 on Wrought Steel Wheels
- TAC 8 on Concrete Reinforcement Steel
- TAC 9 on Rolled or Forged Axles

The most recent committee to hold an organization meeting was TAC 11 on Tubular Products of which T. G. Stitt, Chief Inspecting Engineer, Pittsburgh Steel Co., is chairman. Its main advisory committee met in Washington, March 17. The set-up of this TAC is different than those previously announced in that it is comprised of a main advisory committee with six working sections. Each section is represented by its chairman and one other member on the main committee. The latter also includes official representatives as noted in the accompanying list from various Government agencies, including the War and Navy Depts. which have coöperated very closely in all phases of the work and which are represented on the NESS Administrative Committee.

One of the most important technical advisory committees covering Carbon and Alloy Steel Bars, Blooms, Billets and Slabs (TAC 7) has held a meeting, but since the complete organization of the committee has not been effected, the personnel is not published at this time. The personnel of three of its sections covering Tractor, Farm Implement and Related Industries, Bearings, and Automotive Equipment is listed. Like the TAC on Tubular Products, this TAC 7 consists of representatives from the various sections. In addition to the sections listed others to be organized will cover oil tools, excluding sucker rods, and forging bars and stock. As noted in another article in this Bulletin covering the so-called "8000" series of steels which are being urged as suggested alternates for many of the former standard alloy copositions, there is a research section of TAC 7 to develop and correlate needed information on these 8000 steels. This group is headed by L. E. Ekholm, Metallurgical Engineer, Alan Wood Steel Co., who is Secretary of TAC 7. John Mitchell, Metallurgical Engineer, Alloy Div., Carnegie-Illinois Steel Corp., is chairman of the main committee.

Meetings.—Meetings of all of the technical advisory committees have been held and certain of the sections of the Tubular Products Committee and of the Bar Committee have met. In each case the meetings have been very productive and have made important progress toward the ultimate goal—a selection of a minimum number of specifications, compositions, etc., considered necessary in the war effort.

At a meeting of the main NESS Administrative Committee in Washington on March 10, reports from several TAC's were received and approved. At a meeting in the near future the five members of the Administrative Committee will act formally to refer these to the WPB Iron and Steel Branch, through H. J. French, Senior Consultant.

Personnel of Technical Advisory Committee on Tubular Steel Products—TAC 11

Scope: Corrosion and heat resisting, standard and pressure piping, pressure tubes, oil country tubular goods, water well and water main pipe, and mechanical tubing, except aircraft tubing.

Chairman: T. G. Stitt, Chief Inspecting Engineer, Pittsburgh Steel Co.

Government:

Representing the *War Department*
- Maj. J. H. Frye; U.S.A., Ordnance, War Dept., Room 1350, Social Security Bldg., Washington, D. C.
- Alternate: R. W. White; Specs. Section, Office Chief of Ordnance, War Dept., Room 1362, Social Security Bldg., Washington, D. C.

Representing the *Navy Department*
- Comdr. G. A. Hunt; U.S.N. Bureau of Yards & Docks, Room 4423, Navy Bldg., Washington, D. C.
- F. R. Nagley; Associate Engineer, Bureau of Ships, Navy Dept., Washington, D. C.
- M. S. Noyes; Senior Engineer, Bureau of Ships, Navy Dept., Washington, D. C.

Representing the *Federal Specifications Executive Committee*
- A. S. Best; Secretary of Pipe, Fittings, Valves, etc., Committee F.S.E.C., National Bureau of Standards, Manse Bldg., Washington, D. C.

Representing the *Bureau of Marine Inspection and Navigation*
- P. A. Ovenden; Bureau of Marine Inspection & Navigation, Dept. of Commerce Bldg., Washington, D. C.

Industrial Consumers and General Interests:
- J. L. Bergvall; Assistant to Chief Surveyor, American Bureau of Shipping, 47 Beaver St., New York, N. Y.
- Sabin Crocker; Senior Engineer, Engr. Div., Detroit Edison Co., 2000 2nd Ave., Detroit, Mich.
- H. W. Ladd; Superintendent of Materials, Stanolind Oil & Gas Co., Tulsa, Okla.
- H. L. Maxwell; Metallurgist, Engineering Dept., Experimental Station, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.
- Reeves Newsom; Engineering Consultant, 500 Fifth Ave., New York, N. Y.
- H. B. Oatley; Vice-President, The Superheater Co., 60 E. 42nd St., New York, N. Y.
- J. Roy Tanner; Sales Engineer, Tanner & Arnold, 720 Gulf Bldg., Pittsburgh, Pa.

Producers:

R. E. Barnard; Advisory Engineer, Spiral Welded Pipe Dept., American Rolling Mill Co., Middletown, Ohio

J. J. Dunn; Assistant to Vice-President, National Tube Co., Pittsburgh, Pa.

Newell Hamilton; Metallurgical Engineer, Babcock & Wilcox Tube Co., Beaver Falls, Pa.

H. K. Ihrig; Director of Laboratories, Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee, Wis.

H. R. Redington; Secretary of Specification Committee, National Tube Co., Frick Bldg., Pittsburgh, Pa.

T. G. Stitt; Chief Inspecting Engineer, Pittsburgh Steel Co., Allenport, Pa.

L. H. Winkler; Metallurgical Engineer, Bethlehem Steel Co., Bethlehem, Pa.

Consulting Members:

J. G. Morrow; Chief Metallurgist, Steel Co. of Canada, Ltd., Hamilton, Ontario, Canada

F. H. Saniter; Supply Directorate, British Purchasing Commission, 1801 K St., N. W., Kedrick Bldg., Room 301, Washington, D. C.

Alternate: H. L. Chamberlain; Supply Directorate, British Purchasing Commission, 1801 K St., N. W., Kedrick Bldg., Room 301, Washington, D. C.

Note.—Messrs. Saniter and Chamberlain will serve as *Consulting Members* on each of the six sections, the personnel of which follows:

Section I on Tubular Products—10% Mean Chromium and Over (Stainless or Corrosion Resisting)

Chairman: H. K. Ihrig; Director of Laboratories, Globe Steel Tubes Co.

Government Representatives:

Representing the *Navy Department*

F. R. Nagley, Associate Engineer, Bureau of Ships, Navy Dept., Washington, D. C.

Industrial Consumers and General Interests:

W. F. Hodges; Schenectady Works Laboratory, General Electric Co., Schenectady, N. Y.

G. C. Holder; Chief Chemical and Metallurgical Engineer, Foster Wheeler Corp., Carteret, N. J.

S. L. Hoyt; Technical Adviser, Battelle Memorial Institute, 505 King Ave., Columbus, Ohio

H. L. Maxwell; Metallurgist, Engineering Dept., Experimental Station, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

T. Holland Nelson; Consulting Metallurgist, Villanova, Pa.

George W. Putnum, Vice-President, Creamery Package Co., 1243 W. Washington Blvd., Chicago, Ill.

Producers:

C. R. Baker; National Tube Co., Ellwood City, Pa.

H. K. Ihrig; Director of Laboratories, Globe Steel Tubes Co., 3839 W. Burnham St., Milwaukee, Wis.

A. K. Smalley, Manager of Sales, Carpenter Steel Co., Roselle, N. J.

S. L. Willis; Chief Process Engineer, Steel and Tubes Div., Inc., Republic Steel Corp., Cleveland, Ohio

Section II on Standard and Pressure Pipe

Chairman: H. R. Redington; Secretary of Specification Committee, National Tube Co.

Government Representatives:

Representing the *War Department*

R. W. White; Specs. Section, Office Chief of Ordnance, War Dept., Room 1362, Social Security Bldg., Washington, D. C.

Representing the *Navy Department*

M. S. Noyes; Senior Engineer, Bureau of Ships, Navy Dept., Washington, D. C.

Representing the *Bureau of Marine Inspection and Navigation*

P. A. Ovenden; Bureau of Marine Inspection & Navigation, Dept. of Commerce Bldg., Washington, D. C.

Industrial Consumers and General Interests:

D. G. Brandt; Electric Advisers, Inc., 60 Wall Tower, New York, N. Y.

Sabin Crocker; Senior Engineer, Engr. Div., Detroit Edison Co., 2000 Second Ave., Detroit, Mich.

A. M. Houser; Engineer of Standardization, Crane Co., 836 S. Michigan Ave., Chicago, Ill.

C. A. Kelting; Assistant Division Engineer, Consolidated Edison Co. of New York, Inc., 4 Irving Place, New York, N. Y.

H. H. Morgan; Chief Engineer, Robert W. Hunt Co., 2200 Insurance Exchange Bldg., Chicago, Ill.

J. R. Tanner; Sales Engineer, Tanner and Arnold, 728 Gulf Bldg., Pittsburgh, Pa.

Producers:

C. L. Clark; Research Metallurgical Engineer, Steel & Tube Div., Timken Roller Bearing Co., Canton, Ohio

Newell Hamilton; Metallurgical Engineer, Babcock & Wilcox Tube Co., Beaver Falls, Pa.

S. H. Kilmer; Chief Inspector, Spang-Chalfant Div., National Supply Co., Ambridge, Pa.

H. R. Redington; Secretary of Specification Committee, National Tube Co., Frick Bldg., Pittsburgh, Pa.

J. J. Shuman; Inspecting Engineer, Jones & Laughlin Steel Corp., 3rd Ave. & Ross St., Pittsburgh, Pa.

J. A. Smail; Metallurgical Engineer, Republic Steel Corp., Youngstown, Ohio

L. H. Winkler, Metallurgical Engineer, Bethlehem Steel Co., Bethlehem, Pa.

Section III on Pressure Tubes

Chairman: H. B. Oatley; Vice-President, The Superheater Co.

Government:

Representing the *Navy Department*

F. R. Nagley; Associate Engineer, Bureau of Ships, Navy Department, Washington, D. C.

Representing the *Bureau of Marine Inspection and Navigation*

P. A. Ovenden; Bureau of Marine Inspection & Navigation, Dept. of Commerce Bldg., Washington, D. C.

Industrial Consumers and General Interests:

A. B. Bagsar; Chief Metallurgist, Sun Oil Co., Marcus Hook, Pa.

J. C. Bergvall; Assistant to Chief Surveyor, American Bureau of Shipping, 47 Beaver St., New York, N. Y.

W. F. Collins; Engineer of Tests, N. Y. Central System, 466 Lexington Ave., New York, N. Y.

A. D. Eplett; Chief Metallurgical Engineer, Manning, Maxwell & Moore, Inc., 11 Elias St., Bridgeport, Conn.

Max B. Higgins, Refining Dept., The Texas Co., 205 E. 42nd St., New York, N. Y.

H. J. Kerr; Executive Assistant, Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.

H. B. Oatley; Vice-President, The Superheater Co., 60 E. 42nd St., New York, N. Y.

A. C. Weigel; Vice-President, Combustion Engineering Co., 200 Madison Ave., New York, N. Y.

Producers:

Newell Hamilton; Metallurgical Engineer, Babcock & Wilcox Tube Co., Beaver Falls, Pa.

F. C. Raab; National Tube Co., Ellwood City, Pa.

E. C. Sleeman; Chief Engineer, Detroit Seamless Steel Tubes Co., Box A, Grand River Station, Detroit, Mich.

T. G. Stitt; Chief Inspecting Engineer, Pittsburgh Steel Co., Allenport, Pa.

H. C. Weirick; Inspection Engineer, Steel and Tube Div., Timken Roller Bearing Co., Canton, Ohio

A. J. Williamson; Chief Metallurgist, Summerill Tubing Co., Bridgeport, Pa.

Section IV on Oil Country Tubular Goods

Chairman: H. W. Ladd; Superintendent of Materials, Stanolind Oil & Gas Co.

Industrial Consumers and General Interests:

D. G. Brandt; Electric Advisers, Inc., 60 Wall Tower, New York, N. Y.

C. A. Dunlop; Supervising Petroleum Engineer, Humble Oil & Refining Co., Houston, Tex.

H. W. Ladd; Superintendent of Materials, Stanolind Oil & Gas Co., Tulsa, Okla.

H. N. Marsh; Chief Production Engineer, General Petroleum Corp. of Calif., 2525 E. 37th St., Los Angeles, Calif.

P. A. Mills; President, Moody Engineering Co., Inc., Highland Bldg., Pittsburgh, Pa.

B. B. Wescott; Chief, Materials & Products Chemical Div., Gulf Research & Development Co., Pittsburgh, Pa.

Producers:

J. J. Dunn; Assistant to Vice-President, National Tube Co., Pittsburgh, Pa.

W. R. Kepler; Assistant Chief Engineer, A. O. Smith Corp., 27th St. & Keefe Ave., Milwaukee, Wis.

W. M. Neckerman; Assistant Vice-President, Republic Steel Corp., Youngstown, Ohio

A. H. Quay; Chief Inspector, Jones & Laughlin Steel Corp., Aliquippa, Pa.

J. C. Siegle; General Superintendent, Tube Div., Youngstown Sheet and Tube Co., Youngstown, Ohio

SECTION V ON WATER WELL PIPE

Chairman: L. H. Winkler; Metallurgical Engineer, Bethlehem Steel Co., Inc.

Industrial Consumers and General Interests:

J. A. Carr; Superintendent, Village of Ridgewood, Water Dept., Ridgewood, N. J.
J. C. Harding; Commissioner of Public Works, Westchester County, White Plains, N. Y.
W. W. Hurlbut; Assistant General Manager and Chief Engineer, Los Angeles Dept. of Water Power, Los Angeles, Calif.
O. J. Muegge; Senior Assistant Sanitation Engineer, State Board of Health, State Office Bldg., Madison, Wis.
R. Newsom; Engineering Consultant, 500 Fifth Ave., New York, N. Y.

Producers:

W. O. Clinedinst; National Tube Co., Pittsburgh, Pa.
G. P. Hansen; General Manager, Benwood Works, Wheeling Steel Corp., Benwood, W. Va.
S. H. Kilmer; Chief Inspector, Spang-Chalfant Div., National Supply Co., Ambridge, Pa.
J. W. Owings; Superintendent of Field Engineers, Tube Div., Youngstown Sheet & Tube Co., Youngstown, Ohio
L. H. Winkler; Metallurgical Engineer, Bethlehem Steel Co., Inc., Be hlehem, Pa.

SECTION VI ON WATER MAIN PIPE

Chairman: R. E. Barnard; Advisory Engineer, Spiral Welded Pipe Dept., American Rolling Mill Co.

Industrial Consumers and General Interests:

F. A. Barbour; Civil and Sanitation Engineer, 1120 Tremont Bldg., Boston, Mass.
W. W. Brush; Editor, *Water Works Engineering*, 24 W. 42nd St., New York, N. Y.
G. H. Fenkell; R.F.D., Fenkell Farms, Almont, Lapeer County, Mich.
H. R. Hall; Chief Engineer, Washington Suburban Sanitary Dist., Hyattesville, Md.
W. W. Hurlbut; Assistant General Manager and Chief Engineer, Los Angeles Dept. of Water Power, Los Angeles, Calif.
R. Newsom; Engineering Consultant, 500 Fifth Ave., New York, N. Y.
M. Pirnie; Consultant Engineer, 25 W. 43rd St., New York, N. Y.
F. M. Randlett; Vice-President and General Manager, Robert W. Hunt Co., 175 W. Jackson Blvd., Chicago, Ill.
J. F. Skinner; Consulting Engineer, 1610 Idlewood Road, Glendale, Calif.
T. H. Wiggin; Consulting Engineer, 90 Broad St., New York, N. Y.

Producers:

R. E. Barnard; Advisory Engineer, Spiral Welded Pipe Dept., American Rolling Mill Co., Middletown, Ohio
W. H. Cates; Hydraulic Engineer, Western Pipe & Steel Co. of Calif., 5717 Santa Fe Ave., Los Angeles, Calif.
H. M. Chadwick; California Corrugated Culvert Co., Berkeley, Calif.
A. A. Chambers; Chief Metallurgist, Youngstown Sheet & Tube Co., Youngstown, Ohio
G. H. Garrett; General Manager, Thompson Mfg. Co., 3001 Laramer St., Denver, Colo.
H. S. Grassman; Advisory Engineer, Taylor Forge & Pipe Works, P. O. Box 485, Chicago, Ill.
L. B. Grindlay; Metallurgical Dept., Republic Steel Corp., Youngstown, Ohio
H. O. Hill; Assistant Chief Engineer, Fabricated Steel Construction, Bethlehem Steel Co., Inc., Bethlehem, Pa.
C. S. Patton, Alco Products Co., 30 Church St., New York, N. Y.
H. R. Redington, Secretary of Specification Committee, National Tube Co., Frick Bldg., Pittsburgh, Pa.

Personnel of Certain Sections of Technical Advisory Committee on Carbon and Alloy Steel Bars—TAC 7

(See text material on page 64)

Tractor, Farm Implement and Accessories Section

Chairman: Hyman Bornstein; Director of Laboratories, Deere and Co.

Industrial Consumers and General Interests:

Hyman Bornstein; Director of Laboratories, Deere and Co., Moline, Ill.
R. Bowman; Chief Metallurgist, Minneapolis-Moline Power Implement Co., Minneapolis, Minn.
D. T. Gleason; Vice-President, Standard Steel Spring Co., 846 Fourth Ave., Coraopolis, Pa.
H. W. Gustafson; Plant Manager, Oliver Farm Equipment Co., Springfield, Ohio
J. T. Jarman; Chief Metallurgist, Allis-Chalmers Mfg. Co., West Allis, Wis.
W. H. Naegely; Chief Metallurgist, J. I. Case Co., 700 State St., Racine, Wis.
W. W. Patrick; Chief Metallurgist, Ingersoll Steel & Disc Co., New Castle, Ind.
L. S. Pfost; Vice-President, Massey-Harris Co., 615 S. Marquette St., Racine, Wis.
G. Riegel; Chief Metallurgist, Caterpillar Tractor Co., Peoria, Ill.
J. E. Robinson; Chief Metallurgist, International Harvester Co., Chicago, Ill.
W. A. Silliman; Chief Metallurgist, Cleveland Tractor Co., Cleveland, Ohio

Producers:

R. S. Archer; Chief Metallurgist, Republic Steel Corp., 118th St. & Calumet River, Chicago, Ill.
H. W. Browell; Department of Inspection & Metallurgy, Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
B. F. Courtwright; Superintendent, Met. & Insp., Wisconsin Steel Co., 2701 E. 106th St., Chicago, Ill.
A. L. Kaye; Manager, Alloy Bureau, Carnegie-Illinois Steel Corp., Chicago, Ill.
F. Robbins, Assistant Sales Manager, Bliss & Laughlin, Inc., Harvey, Ill.
E. T. Walton, Superintendent, Met. & Insp., Crucible Steel Co. of America, Midland, Pa.

Bearing Steel Section

Chairman: L. A. Lanning; Assistant Plant Manager, New Departure Div., General Motors Corp.

Industrial Consumers and General Interests:

Roller Bearing

E. U. Blanchard; Chief Metallurgist, Bower Roller Bearing Co., Detroit, Mich.
H. J. Deal; Tyson Roller Bearing Co., Massillon, Ohio
A. S. Jameson; Works Metallurgist, International Harvester Co., West Pullman Works, Roseland Station, Chicago, Ill.
H. T. Morton; Chief Metallurgist, Hoover Ball & Bearing Co., Ann Arbor, Mich.
E. S. Rowland; Research Metallurgist, Steel & Tubes Div., The Timken Roller Bearing Co., Canton, Ohio
J. Wyzalek; Chief Metallurgist, Hyatt Roller Bearing Div., General Motors Corp., Harrison, N. J.

Ball Bearing

R. H. Coolidge; Strom Steel Ball Co., 1842–50 S. 54th Ave., Chicago, Ill.
L. A. Cummings; Chief Engineer, Marlin-Rockwell Corp., Jamestown, N. Y.
L. A. Lanning; Assistant Plant Manager, New Departure Div., General Motors Corp., Bristol, Conn.
Haakon Styri; Director of Research, S. K. F. Industries, Inc., Philadelphia, Pa.
C. T. Hewitt; Chief Metallurgist, Fafnir Bearing Co., New Britain, Conn.
F. L. Wright; Metallurgist, Norma-Hoffman Bearings Corp., Stamford, Conn.

Producers:

W. J. Buechling; Chief Metallurgist, Copperweld Steel Co., Warren, Ohio
W. G. Bischoff; Metallurgical Engineer, Steel & Tube Div., The Timken Roller Bearing Co., Canton, Ohio
B. H. DeLong; Chief Metallurgist, Carpenter Steel Co., Reading, Pa.
L. L. Ferrall; Metallurgical Engineer, Rotary Electric Steel Co., Ferndale Station, Detroit, Mich.
M. J. R. Morris; Chief Metallurgical Engineer, Republic Steel Corp., Massillon, Ohio
A. L. Sprankle; Carnegie-Illinois Steel Corp., Pittsburgh, Pa.
E. T. Walton; Crucible Steel Company of America, Midland, Pa.

Consulting Member:

T. G. Stitt; Chief Inspecting Engineer, Pittsburgh Steel Co., Allenport, Pa.

Automotive Equipment Section

Chairman: W. P. Eddy, Jr., Metallurgist, Yellow Truck & Coach Mfg. Co.
Co-chairman: E. C. Mann; Chevrolet Motor Car Co.

Industrial Consumers and General Interests:

John Anglim; Nash Kelvinator Corp., Kenosha, Wisc.
E. F. Davis; Chief Metallurgist, Warner Gear Div., Borg Warner Corp., Muncie, Ind.
W. E. Day, Jr.; Metallurgist, Mack Mfg. Corp., New Brunswick, N. J.
W. J. Diederichs; Metallurgist, Autocar Co., 107 Simpson Rd., Ardmore, Pa.
W. P. Eddy, Jr.; Metallurgist, Yellow Truck & Coach Mfg. Co., Pontiac, Mich.
T. A. Frishman; Eaton Mfg. Co., Toledo, Ohio
J. Gagnon; Chief Metallurgist, Hudson Motor Car Co., Detroit, Mich.
G. A. Goepfert; Ross Gear & Tool Co., Lafayette, Ind.
A. A. Lyman; Automotive Engineer, Public Service Coordinated Transport, 80 Park Place, Newark, N. J.
E. C. Mann, Chevrolet Motor Car Co., Detroit, Mich.
E. Peebles; Detroit Steel Products Co., Detroit, Mich.
J. E. Robinson; International Harvester Co., Chicago, Ill.
R. W. Roush; Metallurgist, Timken-Detroit Axle Co., 100 Clarke St., Detroit, Mich.
R. B. Schenck; Metallurgist, Buick Motor Co., Flint, Mich.
E. H. Stillwell; Chrysler Corp., Detroit, Mich.
Lloyd Webb; Frost Gear & Forge Co., Jackson, Mich.
S. L. Widrig; Chief Metallurgist, Spicer Mfg. Corp., 4100 Bennett Rd., Toledo, Ohio
F. C. Young; Chem. Met. Dept., Ford Motor Co., Dearborn, Mich.

Producers:

H. W. Browall; Dept. Insp. & Met., Inland Steel Co., 38 S. Dearborn St., Chicago, Ill.
L. L. Ferrall; Metallurgical Engineer, Rotary Electric Steel Co., Detroit, Mich.
A. L. Kaye; Manager, Alloy Bureau, Carnegie-Illinois Steel Corp., Chicago, Ill.
C. W. Laufle; Manager, Alloy Div., Great Lakes Steel Corp., Ecorse, Detroit, Mich.
H. A. Moorhead; Metallurgical Engineer, Bar & Semi-Finished Products, Carnegie-Illinois Steel Corp., 1207 Carnegie Bldg., Pittsburgh, Pa.
M. J. R. Morris; Chief Metallurgical Engineer, Republic Steel Corp., Massillon, Ohio
W. Rodgers; Metallurgical Engineer, Republic Steel Corp., Cleveland, Ohio
H. M. Smith; Chief Metallurgist, Wycoff Drawn Steel Co., Ambridge, Pa.
E. T. Walton; Supt. of Metallurgy & Inspection, Pittsburgh Crucible Steel Co. of America, Midland, Pa.
H. Wysor; Metallurgical Engineer, Bethlehem Steel Co., Inc., Bethlehem, Pa.

Appointments to Administrative Committees

A list of members appointed to certain administrative committees is given below. An asterisk indicates a reappointment.

COMMITTEE E-1 ON METHODS OF TESTING (appointed for a three-year term):
*W. H. Fulweiler, Consulting Chemist, Philadelphia
*H. F. Moore, University of Illinois
T. S. Fuller, General Electric Co.

COMMITTEE E-6 ON PAPERS AND PUBLICATIONS (appointed for a three-year term):
J. C. Geniesse, Atlantic Refining Co.
W. H. Gardner, Polytechnic Institute of Brooklyn
H. S. Rawdon, National Bureau of Standards

COMMITTEE E-8 ON NOMENCLATURE AND DEFINITIONS (appointed for a three-year term):
*R. P. Anderson, American Petroleum Institute
*C. M. Chapman, Consulting Engineer, New York

COMMITTEE E-9 ON RESEARCH (appointed for a five-year term):
C. H. Scholer, Kansas State College of Agriculture and Applied Science

COMMITTEE E-10 ON STANDARDS (appointed for a three-year term):
R. D. Bonney, Congoleum-Nairn, Inc.
F. H. JACKSON, Public Roads Administration

Society Appointments

Announcement is made of the following Society appointments:

T. S. FULLER, General Electric Co., as the Society's representative on the Division of Engineering and Industrial Research of the National Research Council, succeeding L. M. Currie, Bakelite Corp.

W. F. BARTOE, Röhm & Haas Co., as the Society's representative on the Inter-Society Color Council, on the recommendation of Committee D-20 on Plastics.

R. M. HAVOURD, Public Service Electric and Gas Co., to succeed Merrill deMerit as a representative of the Society on the A.S.A. Sectional Committee C29 on Glass Insulators.

R. J. MCKAY, The International Nickel Co., as the Society's representative on the American Coordinating Committee on Corrosion, succeeding F. F. Farnsworth, Bell Telephone Laboratories, Inc., resigned.

Schedule of Meetings

DATE	COMMITTEE	PLACE
April 13, 14	Executive Committee	Pittsburgh, Pa.
April 23	A-3 on Cast Iron	Cleveland, Ohio
March 30	PITTSBURGH DISTRICT	Pittsburgh, Pa.
April 30	PHILADELPHIA DISTRICT	Philadelphia, Pa.
June 22–26	FORTY-FIFTH ANNUAL MEETING	Atlantic City, N. J.

NECROLOGY

We announce with regret the death of the following members and representatives:

JOHN C. CRAVEN, Naval Architect, Federal Shipbuilding and Dry Dock Co., New York, N. Y. For several years and up to the time of his death Mr. Craven represented his company in its membership on Committees A-1 on Steel and Subcommittee III on Structural Steel for Ships and A-5 on Corrosion of Iron and Steel.

C. C. DENNIS, General Superintendent, American Locomotive Co., Railway Steel-Spring Division, New York, N. Y.

WILLIAM FLANNERY, Mechanical Engineer, Department of Water Supply, New York, N. Y. Member since 1930.

C. D. HOLLEY, Director of Paint Research, The Sherwin-Williams Co., Chicago, Ill. Doctor Holley's contributions to the work of the Society were many, particularly through his activities on Committee D-1 on Paint, Varnish, Lacquer, and Related Products, where, in addition to service as chairman of the Advisory Committee and Vice-Chairman of D-1, he was active in the work of several subcommittees concerned with accelerated tests, varnish, pigment specifications, and painting of structural iron and steel. He represented his company on Committee B-2 on Non-Ferrous Metals and Alloys, and also served A.S.T.M. as a member of Committee E-9 on Research.

ALEXANDER JARECKI, President, Jarecki Manufacturing Co., Ltd., Erie, Pa. Member since 1896.

ANDREW W. KEEGAN, SR., In Charge of Testing, Kent Manufacturing Co., Clifton Heights, Pa. Member since 1926. Mr. Keegan was a member of Committee D-13 on Textile Materials and served on Subcommittee A-3 on Wool and Its Products, Section I on Wool and Section II on Felt.

HENRY LINDENBERGER, President, U. S. Reduction Co., East Chicago, Ind. Member beginning in 1935, and since that year had been a member also of Committees B-6 on Die-Cast Metals and Alloys and B-7 on Light Metals and Alloys, Cast and Wrought, serving on three subcommittees of the latter—aluminum ingots and castings and anodic oxidation.

JAMES P. MARTIN, Vice-President, Lancaster Iron Works, Inc., Brick Machinery Division, Lancaster, Pa.

NEW MEMBERS TO MARCH 10, 1942

The following 72 members were elected from January 14 to March 10, 1942:

Chicago District

Cutler-Hammer, Inc., P. J. Ritzenthaler, Chemist, Twelfth St. and St. Paul Ave., Milwaukee, Wis.

Johnson and Son, Inc., S. C., J. Vernon Steinle, Research Director, 1525 Howe St., Racine, Wis.

Holdampf, C. R., Structural Engineer, Klug & Smith Co., Milwaukee, Wis. For mail: 5912 N. Berkeley Boulevard, Milwaukee, Wis.

Horstmann, F. B., Technical Director, Dearborn Chemical Co., 310 S. Michigan Ave., Chicago, Ill.

Loch, Joseph, Ordnance Inspector, War Dept., Chicago Ordnance District, Chicago, Ill. For mail: 2027 N. Sheffield Ave., Chicago, Ill. [J]*

Malan, Lowell, Chief Chemist, The United Electric Coal Cos., Chicago, Ill. For mail: 427 E. North St., DuQuoin, Ill.

Nehring, Paul, Jr., Assistant Secretary-Treasurer, Nehring Electrical Works, DeKalb, Ill.

Pickett, Gerald, Research Physicist, Portland Cement Assn., 33 W. Grand Ave., Chicago, Ill.

Cleveland District

Lindsay Wire Weaving Co., The, D. C. Dilley, Metallurgist, 14025 Aspinwall Ave., Cleveland, Ohio.

McClure, R. R., Chief Chemist, Pure Calcium Products Division, Diamond Alkali Co., Box 407, Painesville, Ohio.

Zimmerman, H. Arthur, Engineer, The Weatherhead Co., 300 E. 131st St., Cleveland, Ohio. [J]

Detroit District

Banghart, L. E., Chief Engineer, Union Steam Pump Co., Battle Creek, Mich.

Beckwith, M. M., Development Engineer, The J. B. Ford Sales Co., Wyandotte, Mich.

Goetsch, E. G., Junior Engineer, Drive-All Manufacturing Co., Detroit, Mich. For mail: 5395 Seminole, Detroit, Mich. [J]

MacDermid, Inc., Waterbury, Conn., Harold Leever, Western Manager, 241 W. Drayton, Ferndale, Mich.

Schultz Die Casting Co., J. A. Zapf, President, 1810 Clinton St., Toledo, Ohio.

New York District

Amitas Limited, A. F. Thomas, Purchasing Manager, Suite 1700, 50 Broadway, New York, N. Y.

Bead Chain Manufacturing Co., The, Newell R. Smith, Director of Research and Engineering, Barnum Station, Bridgeport, Conn.

Chester, W. F., Chemist, Park Dept., City of New York, 126th St. and Northern Boulevard, Corona, N. Y.

Chisdes, Meyer, Chemist, The Port of New York Authority, New York, N. Y. For mail: 999 Westside Ave., Jersey City, N. J.

Deppeler, J. H., Chief Engineer, Metal and Thermit Corp., Room 2202, 120 Broadway, New York, N. Y.

Farnsworth, Marie, Research Chemist, Metal and Thermit Corp., Research Laboratory, Box 255, Rahway, N. J.

Hogaboom, G. B., Jr., Chemical Engineer, G. B. Hogaboom, Jr., and Co., 352 Mulberry St., Newark, N. J.

Nelson, F. L., Socony-Vacuum Oil Co., Inc., Brooklyn, N. Y. For mail: 357 Ninth St., Brooklyn, N. Y. [J]

Picker X-Ray Corp., L. C. Kotraschek, Manager, Industrial Division, 300 Fourth Ave., New York, N. Y.

Roberts, T. W., Technician, Consumers' Research, Inc., Washington, N. J.

Wilner, Selig, Materials Engineer in Charge, Federal Works Agency, Works Progress Administration, Physical Testing Laboratory, College of the City of New York, New York, N. Y. For mail: 3514 Rochambeau Ave., New York, N. Y.

Northern California District

Quick, R. S., Chief Engineer, The Pelton Water Wheel Co., 2929 Nineteenth St., San Francisco, Calif.

Philadelphia District

Hilles, R. W., Counsellor on Portland Cement, 123 S. Broad St., Philadelphia, Pa.

Lancaster Iron Works, Inc., James K. Martin, Manager, Brick Machinery Division, Lancaster, Pa.

Murray, J. W., Chief Chemist, Thomasville Stone and Lime Co., Thomasville, Pa.

Pennsylvania Salt Manufacturing Co., W. M. Swain, 1000 Widener Building, Philadelphia, Pa.

Potter, C. W., Engineer of Tests, Bethlehem Steel Co., Steelton Plant, Steelton, Pa.

Raub, Franklin, Textile Inspector, Philadelphia Quartermaster Depot, Philadelphia, Pa. For mail: Grange Ave., R. D. 1, Collegeville, Pa.

Sadtler, Philip, Vice-President and Secretary, Samuel P. Sadtler and Son, Inc., 210 S. Thirteenth St., Philadelphia, Pa.

Pittsburgh District

Muhlenbruch, C. W., Instructor in Civil Engineering, Department of Civil Engineering, Carnegie Institute of Technology, Pittsburgh, Pa. [J]

Owens, F. R., Secretary, Cyrus William Rice and Co., Inc., 15 Noble Ave., Crafton, Pa.

Proudfoot, D. G., Manager, Sales Engineering Dept., The Pennzoil Co., Oil City, Pa. For mail: Box 78, Oil City, Pa.

St. Louis District

Azbe, V. J., Consulting Engineer, 6625 Delmar Boulevard, St. Louis, Mo.

Harness, F. E., Metallurgist, Gardner-Denver Co., Quincy, Ill.

Southern California District

Carlson, R. E., Chief Engineer, Grayson Heat Control, Ltd., Lynwood, Calif. For mail: 3000 Imperial Highway, Lynwood, Calif.

Horsfall, W. P., Junior Research Assistant, Lockheed Aircraft Corp., Burbank, Calif. For mail: 12081 1/2 Hoffman St., Studio City, Calif. [J]

Los Angeles, City of, Department of Supplies, A. J. Holm, Purchasing Agent, Room 107, City Hall, Los Angeles, Calif.

Schleker, R. C., Laboratory Foreman, Eagle Oil and Refining Co., Inc., Santa Fe Springs, Calif. For mail: 401 Osgood Ave., Long Beach, Calif.

U. S. and Possessions

Other than A.S.T.M. Districts

American Air Filter Co., Inc., Arthur Nutting, Chief Engineer, 215 Central Ave., Louisville, Ky.

Cummins & Grant, H. Clifford Grant, Jr., Technical Director, 9 N. Eutaw St., Baltimore, Md.

Louisiana Power and Light Co., R. L. Phillips, Station Superintendent, Sterlington, La.

Todd-Bath Iron Shipbuilding Corp., J. L. Trott, Chief Engineering Draftsman, South Portland, Me.

Blirer, A. E., Assistant Production Officer, U. S. Naval Gun Factory, Navy Yard, Washington, D. C. For mail: 518 Second St., S. E., Washington, D. C.

Brinn, James, Plant Superintendent, Northwestern Iron and Metal Co., Lincoln, Nebr. For mail: 1454 Washington St., Lincoln, Nebr.

Brown, H. F., Chemist Assistant, Semet-Solvay Co., Ironton, Ohio. For mail: 2738 S. Ninth St., Ironton, Ohio. [J]

Christensen, Boyd, Tool Designer, Boeing Airplane Co., Wichita Division, Wichita, Kans. For mail: 221 S. Crest Way, Wichita, Kans. [J]

DeCoursey, E. M., Chief Engineer, Auburn Manufacturing Co., Auburn, Ind.

Ford, A. E., General Manager, Green Bag Cement Co. of West Virginia, Kenova, W. Va.

Gaither, C. D., Director, Testing Laboratory, West Point Manufacturing Co., Shawmut Mill Division, Shawmut, Ala.

Hopkins, J. B., President, Albany Gravel Co., Inc., Albany, N. Y. For mail: 278 Amsterdam Ave., Menands, N. Y.

Hill, R. B., Manager, Standard Brake Shoe and Foundry Co., Pine Bluff, Ark.

Hughes, E. W., Fuel Technologist, Hercules Powder Co., Radford, Va. For mail: 112 Monroe Terrace, Radford, Va. [J]

Lazan, B. J., Instructor, The Pennsylvania State College, 212 Engineering A, State College, Pa. [J]

Maguire, W. J., Superintendent of Public Buildings, Division of Public Buildings, City Hall, Providence, R. I.

Matthews, W. F., City Analyst, City of Muskegon; and Metallurgical Chemist, Continental Motors Corp., Muskegon, Mich. For mail: 2504 Crozier St., Muskegon, Mich. [J]

Mayeron, Leonard, Materials Engineer, Minneapolis-Honeywell Regulator Co., 2753 Fourth Ave. South, Minneapolis, Minn.

McCallum, C. S., President, McCallum Inspection Co., 132 W. Berkeley Ave., Norfolk, Va.

Meyers, G. L., Jr., Assistant Professor, Department of Chemistry, Oklahoma Agricultural and Mechanical College, Stillwater, Okla. [J]

Mogerman, W. D., Associate Chemist, National Bureau of Standards, Washington, D. C. For mail: 2803 Cortland Place, N. W., Washington, D. C.

Nunn, A. E., Signal Mountain Portland Cement Co., Chattanooga, Tenn.

Oshkosh Public Library, Natalie T. Huhn, Librarian, Oshkosh, Wis.

Purdue Research Foundation, C. F. Boester, Director, Housing Research, Purdue University, Lafayette, Ind.

Ritter, B. H., Operative Chemist, Hooker Electrochemical Co., Niagara Falls, N. Y.

Schwartz, R. T., Assistant Materials Engineer, Materiel Division, Air Corps, Wright Field, Dayton, Ohio. For mail: 3 Maple Drive, Dayton, Ohio. [J]

Sloan, C. E., Engineer of Bridges, The Baltimore & Ohio Railroad Co., 1302 Baltimore & Ohio Railroad Building, Baltimore & Charles Sts., Baltimore, Md.

South Dakota State College Library, H. D. Stallings, Librarian, Brookings, S. Dak.

Stewart, D. W., Project Manager, Basic Magnesium, Inc., Box 1150, Las Vegas, Nev.

Swift, John, Chief Metallurgist, The Billings & Spencer Co., 1 Laurel St., Hartford, Conn.

Other than U. S. and Its Possessions

United British Oilfields of Trinidad, Ltd., 15 Abercromby St., Port-of-Spain, Trinidad, B.W.I.

Instituto Uruguayo de Normas Tecnicas, Agraciada 1464, P. 11 Montevideo, Uruguay.

Kungl. Tekniska Hogskolans Bibliotek, Valhallavägen, Stockholm Ö., Sweden.

Linder, L. C., Director, Coubro & Scrutton, Ltd., London, E 14, England. For mail: St. Just, Powell Road, Buckhurst Hill, Essex, England.

New Zealand Dominion Laboratory, Director, Wellington, New Zealand.

Penhale, A. L., Sales Manager, Asbestos Corp., Ltd., Thetford Mines, P. Q., Canada.

Russell, N. E., Manager, General Technical Dept., Aluminum Co. of Canada, Ltd., 158 Sterling Road, Toronto, Ont., Canada.

Sykes, J. A., Managing Director, The Yorkshire Copper Works, Ltd., Leeds, England.

Turner, E. R., Chief Chemist, Canadian Brakeshoe and Foundry Co., Ltd., Sherbrooke, P. Q., Canada. For mail: 33 Arras St., Sherbrooke, P. Q., Canada. [J]

Twyman, Frank, Managing Director, Adam Hilger, Ltd., 98 St. Pancras Way, London, N. W. 1, England.

* [J]—denotes Junior Member.

PERSONALS . . . News items concerning the activities of our members will be welcomed for inclusion in this column.

E. L. Peterson is now Senior Supervising Engineer, Coosa River Ordnance Plant, Corps of Engineering, U. S. Army, Talladega, Ala.

C. L. Hendrick, Architect, Yonge & Hart, Pensacola, Fla., is now on active duty with U. S. Army Engineers.

Pauline Beery Mack, Chemistry Teacher, Chemistry Department, The Pennsylvania State College, State College, Pa., and R. E. Wilson, President, Pan-American Petroleum and Transport Co., New York, N. Y., have been elected to the Board of Directors of the American Standards Association.

E. K. Smith, Metallurgist, Electro Metallurgical Co., Detroit, Mich., has been given leave of absence to become Metallurgist, Tank and Combat Vehicle Division, U. S. Army, Ordnance Department, Washington, D. C.

J. F. Williams, Chief, Division of Laboratories, Bureau of Customs, Washington, D. C., will soon be called into active duty with the U. S. Army.

C. W. Blacketer, formerly Sales Engineer, Pure Calcium Products Division, Diamond Alkali Co., Painesville, Ohio, is now Director of Developments, Martin Varnish Co., Chicago, Ill.

T. A. Boyd, Head, Fuel Department, Research Laboratories Division, General Motors Corp., Detroit, Mich., addressed the Junior group of the Society of Automotive Engineers on January 12, the subject of the talk being "Your 1972 Model—I'd Like to Drive It!"

J. W. Kennedy, Engineer, Service Bureau, Huron Portland Cement Co., has been appointed Assistant Sales Manager.

J. H. Walker, Engineer Assistant to General Manager, The Detroit Edison Co., Detroit, Mich., has completed 30 years of service with the company.

C. G. A. Rosen, formerly Assistant Chief Engineer, In Charge of Diesel Research, Caterpillar Tractor Co., Peoria, Ill., is now Director of Research for this company.

G. C. Gewecke, formerly Assistant Sanitation Engineer, C. MacCallum, Consulting Engineer, Mineola, Pa., is now Structural Designer, Burns & Roe, Inc., Engineering Consultants, New York, N. Y.

C. R. Young, Professor of Civil Engineering, and Dean of the Faculty of Applied Science and Engineering, University of Toronto, was installed as President of the Engineering Institute of Canada at the annual meeting of the Institute held in Montreal on February 5.

C. H. Greenall, formerly in the Apparatus Development Department, Bell Telephone Laboratories, Inc., New York, N. Y., is now Major, Ordnance Department, U. S. Army, Frankford Arsenal, Philadelphia, Pa.

T. C. Ford is General Manager, Keystone Asphalt Products Co., Chicago Heights, Ill. He was Vice-President, American Asphalt Paint Co., Kankakee, Ill.

R. W. Perry, Director, Perry Testing Laboratory, Detroit, Mich., has announced that after 27 years of successful and pleasant operation the laboratory will be closed and business discontinued as of February 28.

J. C. Witt, formerly Technical Service Manager, Marquette Cement Manufacturing Co., Chicago, Ill., is now Technical Director for the same company.

J. E. Viscardi is Research and Development Engineer, Aero Parts Manufacturing Co., Wichita, Kans. He was Engineer in Charge of Physical Testing, Monsanto Chemical Co., Springfield, Mass.

George Granger Brown, for a number of years Consulting Engineer, and Professor of Chemical Engineering, University of Michigan, has been appointed Chairman of the Department of Chemical and Metallurgical Engineering. In this capacity he succeeds a long-time A.S.T.M. member, Prof. A. H. White, who for a great many years has been chairman of the department. In addition to his faculty duties at Michigan, Professor White is devoting considerable time to his duties as President of the Society for the Promotion of Engineering Education.

D. R. MacPherson, who was Industrial Fellow, Mellon Institute of Industrial Research, Pittsburgh, Pa., is now Member of Research Staff, Master Builders Research Laboratories, Cleveland, Ohio.

T. R. Galloway is on wartime leave of absence from Consolidated Edison Co. of New York, Inc., and is now with Singmaster & Breyer, New York, N. Y., on the design of magnesium plants.

H. S. Van Vleet, Research Department, American Can Co., Maywood, Ill., is doing part-time work in Washington as Bureau of Industrial Conservation part-time consultant on tin plate, but is still employed by American Can Co.

T. R. Cuykendall, Assistant Professor of Civil Engineering, Cornell University, Ithaca, N. Y., is in Washington temporarily.

F. L. Wolf, Technical Director, Ohio Brass Co., Mansfield, Ohio, is working temporarily in Washington with the Materials Division, Branch K, War Production Board.

W. H. Bassett, Jr., Manager, Metallurgical Development, Anaconda Wire and Cable Co., Hastings-on-Hudson, N. Y., has been appointed Captain, Ordnance Department, Office of the Chief of Ordnance, Industrial Service, Inspection, and is located in the Social Security Building, Room 4762A, Washington, D. C.

Kalman Steiner, formerly Combustion Engineer, Ray Heat and Power Co., Chicago, Ill., is now Mechanical Engineer, U. S. War Department, Chicago Ordnance District, Chicago, Ill.

E. M. Irwin is Chief Engineer, Magnetest Corp., Long Beach, Calif. He was Manager, Pacific Coast Branch, Waugh Laboratories, Los Angeles, Calif.

The Board of Awards of the American Foundrymen's Association has announced that at the First Western Hemisphere Foundry Congress and 46th Annual Convention of the A.F.A., to be held in Cleveland, April 20 to 24, the J. H. Whiting Gold Medal will be presented to A. L. Boegehold, Chief Metallurgist, General Motors Corp., Research Laboratories, Detroit, Mich., a member of A.S.T.M. Several A.S.T.M. members serve on the Awards Board, including L. N. Shannon, Vice-President, Stockham Pipe Fittings Co., Birmingham, Ala.; Hyman Bornstein, Director of Laboratories, Deere & Co., Moline, Ill.; and James L. Wick, Jr., President and General Manager, Falcon Bronze Co., Youngstown, Ohio.

At the recent annual meeting of the American Institute of Mining and Metallurgical Engineers several A.S.T.M. members were elected to office, as follows: Carl Swartz, Metallurgist, Cleveland Graphite Bronze Co., Cleveland, Ohio,—new chairman of the Institute of Metals Division; and E. C. Smith, Chief Metallurgist, Republic Steel Corp., Cleveland, Ohio—new chairman of the Iron and Steel Division. H. K. Work, Manager of Research and Development, Jones & Laughlin Steel Corp., Pittsburgh, Pa., was the winner of the Robert W. Hunt Award, a gold medal and prize made each year to the person or persons, not necessarily members of the Institute, contributing to the Institute the best original paper or papers on iron and steel.

William Howlett Gardner has resigned his connection as Research Fellow, Shellac Research Bureau, Polytechnic Institute of Brooklyn, Brooklyn, N. Y., to accept an appointment as Consultant on Chemical and Related Products, Specifications Branch, War Production Board's Bureau of Conservation. In this capacity he will be concerned with specification and conservation problems in such fields as preservative coatings, soap and other detergents, and related products.

C. S. Cole, formerly Engineer, Copper & Brass Research Assn., New York, N. Y., is on leave of absence from his company and has been appointed Consultant on Non-Ferrous Metals in the Specifications Branch, Bureau of Industrial Conservation, War Production Board.

J. J. Bowman, formerly with the Aluminum Company of America, New Kensington, Pa., and secretary of the Society's Committee E-4 on Metallography, is on leave of absence from his company and has been appointed Industrial Consultant in the Conservation and Substitutions Branch, Bureau of Industrial Conservation, War Production Board. He is assisting on problems relating principally to aluminum and related elements.

H. L. Rhodes, formerly Manager, The Chemical and Pigments Co., Inc., Baltimore, Md., is now with the Yadkin Valley Illmenite Co., Lenoir, N. C.

R. L. Tippett, formerly Estimator, John McShain, Inc., Philadelphia, Pa., is now Project Manager, Naval Medical Center, Bethesda, Md.

H. J. French, In Charge, Alloy Steel and Iron Development, The International Nickel Co., Inc., New York, N. Y., has recently been appointed Chief Consultant, Iron and Steel Branch, War Production Board. Data appearing on another page of this Bulletin shows the setup of the Iron and Steel Branch. Important work on metallurgical and specification problems will clear through his office. This appointment has been occasioned by the tremendous amount of work handled in this division of the Iron and Steel Branch and will take advantage of Mr. French's recognized abilities in the ferrous field. He is devoting a considerable portion of his time to the work.

In addition to A.S.T.M. members whose Government or related activities are mentioned above, we have been informed that the following members are now in the Service. Where information on the particular branch is available, it is indicated. The connections of the men as they were last listed in the Year Book are also given.

W. P. Munger, IV, Reinforcing Bar Dept., Joseph T. Ryerson and Son, Inc., Buffalo, N. Y.

Donald Hamilton, Engineer, U. S. Forest Service, Washington, D. C., is in the U. S. Army Air Corps.

J. M. Hay, Chemical Engineer, John E. Fast and Co., Chicago, Ill.

E. S. Fraser, Jr., Second Lieutenant, Engineer Reserve, Wichita Falls, Tex.

H. G. Oliver, Jr., Research Engineer, Goetze Gasket and Packing Co., New Brunswick, N. J.

R. S. Armstrong, Chemist (Treater), The Standard Oil Co. (Ohio), Lima, Ohio, is with Federal Troops in the Orient.

For advance notes on the 1942 Annual Meeting, see page 6.

Information on War Production Board, on page 59.

New Tentative Standards and Emergency Alternate Provisions on pages 41 and 42.

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